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VETERINARY MEDICINE

NOVEMBER CONTENTS 1949

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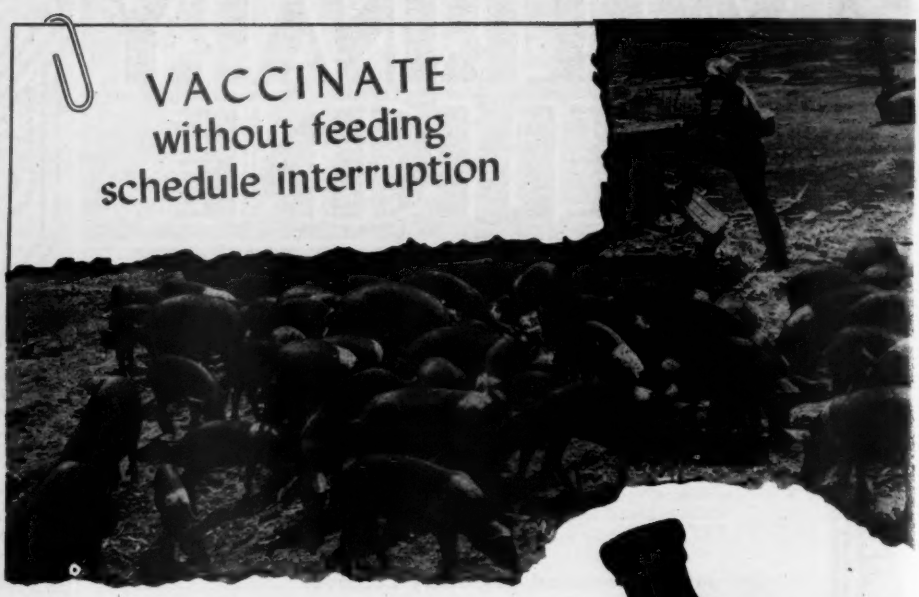

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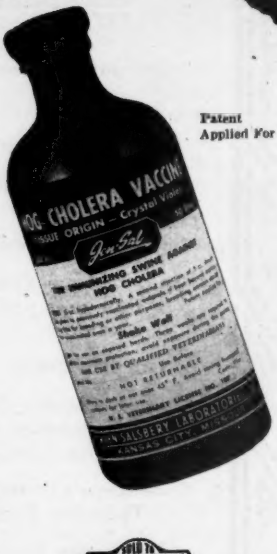

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Good Management Necessary in Control of Swine Influenza

With the change of season and the coming of damp cool weather, swine influenza will begin to make its appearance in swine droves throughout the midwest.

The disease is characterized by sudden onset. Frequently the entire drove is sickened within a day or two after first noticeable symptoms. There is a complete loss of appetite and animals are noted to spend most of the time together in a nest. When aroused there is considerable croupy coughing.

Good swine management is the most effective measure in the control of swine influenza. Sleeping quarters need not be warm but should be well ventilated, free from drafts and dry. Fresh drinking water should be provided at all times, with a good diet and plenty of bedding.

In speaking of the control of swine influenza, it is a serious mistake not to mention the frequency of misdiagnosis, especially in herds that are not cholera-immune.

▼ ▼ ▼

Kill Quarantine Post Bill

President Truman has signed a bill abolishing plans to establish a livestock quarantine station on Swan Island in the Caribbean Sea. The measure was supported by the livestock industry.

On Again—Off Again

Professional and self-employed trade or business men come under the provisions of the Social Security Act, under H.R. 2893. A new bill (H.R. 6000) now has been introduced which exempts physicians, veterinarians and other professional groups from the broadened coverage of the Social Security Act.

▼ ▼ ▼

Tick Fever Reported

Laboratory reports confirm the presence of tick fever among cattle on two ranches near the International border in California, according to a B.A.I. report.

County and State veterinary officials are taking prompt action to control and eradicate the disease. Infected premises are under quarantine and arrangements have been made to dip the cattle in the standard arsenical solution. Field surveys are in progress to determine the extent of the tick area.

The disease is characterized by tick-infested cattle, showing high fever, destruction of red blood corpuscles, enlarged spleen, redwater, and loss of flesh. The death rate is high in infected cattle.

The disease is present south of the American border. Cattlemen in the border counties are urged to be on the lookout for ticks on their cattle and to make prompt reports to the nearest Bureau office.

14th International Veterinary Congress

THE writer has attended five international veterinary congresses and read the reports of the other nine. If the importance of forming the organization at the initial meeting be disregarded, there seems no doubt the recent Congress in London, August 7-13, 1949, was the most important of the lot, and its influence will be greatest. This is to say, it was the most important veterinary assembly to date, for the international veterinary congresses have no rival among national veterinary meetings in influencing veterinary thought and the public appraisal of veterinary science.

By some standards the attendance at the 14th International Veterinary Congress was not large—approximately 1100 veterinarians, 100 veterinary students, and 250 ladies. It would probably have been much larger but for the inadequate facilities for ocean travel and the great difficulty private individuals experienced in overcoming restrictions on the exportation of funds from many countries. Further, the usual large delegations from Germany and smaller numbers from Central and Eastern European countries were almost entirely absent. The number of official delegates — approximately 600 — was probably larger than at any previous congress. Fifty-three nations were represented by official delegates.

An outstanding feature of this Congress was the solemnity that characterized all general sessions. It was apparent that speakers and hearers alike regarded their problems as grave, their responsibilities as onerous. The Rt. Hon. Hector McNeil, Minister of State, struck this chord in the opening address when he said: "Hunger is an international currency and knowledge an international asset. It is a matter of the deepest and most disturbing regret that this is not universally accepted." And again the speaker stated he was obsessed with the possibilities of Africa for food production, but the production of food and raw material in that and other areas had been held down by a barrier which only the veterinary profession could remove. He could not believe there had ever been a time when the opportunities and the rewards of scientists were greater.

The Program of the Congress

The theme of the Congress, as every reader must know by this time, was "The World Food Supply." The subject was chosen by the committee of the Congress because of its conviction that, "political stability in the world cannot be insured unless the food supplies of peoples are assured." Developing this theme the program presented "an imposing and varied array of topics of prime importance in the conservation of our food producing animals." The field covered included the "killing" diseases such as rinderpest and hog cholera; the diseases that interfere with reproduction

Opening session of The 14th International Veterinary Congress, left to right: Prof. J. B. Buxton, Prof. T. Dalling, Sir Weldon Dalrymple Champneys, Sir Daniel Cabot, Prof. J. Verge (standing), Dr. R. F. Montgomerie, Dr. W. R. Wooldridge and Professor Ramon.

such as brucellosis and trichomoniasis; the diseases that interfere with growth and gains—chronic diseases and parasitisms, and deficiency diseases, poisoning, etc., which may operate in the field of any or all the foregoing.

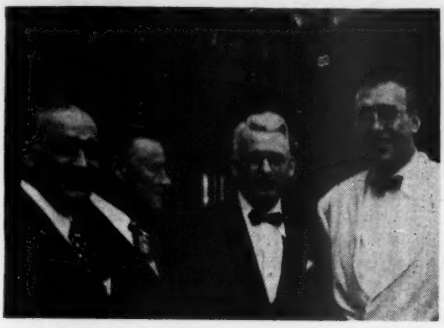
The World Food Situation

The keynote address of the Congress by Lord Boyd Orr, D.S.O., M.C., F.R.S., formerly Director-General of the FAO (Food and Agricultural Organization) of the United Nations, set the stage for a discussion of food conservation and stressed its importance to mankind. He observed that "veterinary medicine is one of the few branches of science in which knowledge can be increased and applied without the danger of doing more harm than good. The advances of physical science in the last 50 years are a positive danger to our civilization . . . Veterinary science has not, so far at least, raised any political or economic problems. The world is desperately short of animal products, and in some countries, especially in Asia, of work bullocks. This shortage can be made good by the elimination of disease and better feeding and management . . . The rapid development and application of veterinary science can do nothing but good.

"The advance of human medicine in lengthening the lifespan poses the question of

whether the earth can provide food for the rapidly increasing population. The present rate of increase is 22 millions a year. At that rate the present population will have increased more than 50% by the end of this century.

"The countries still in the first phase of animal disease control are India and many parts of Eastern Asia and Africa. In these countries major epizoötics, which do not exist or are effectively controlled in countries having good veterinary services, cause a high mortality. The monetary losses and the losses in food are enormous. Until recently the cattle mortality in India from rinderpest was well over 50%. Since the introduction of preventive inoculation



Four American veterinarians at the Congress banquet. Left to right: Doctors C. P. Zepp, James Farquharson, John D. Ray, and James Steele.

this loss has been reduced greatly but it is still in the neighborhood of a million cattle a year.

"When the great animal plagues are brought under control, stock raising develops rapidly and becomes more intensive; certain chronic infections usually arise. These diseases, mastitis, brucellosis, parasitisms, infertility, etc., all give rise to great losses. When they, in turn, are brought under control, animal productivity increases and digestive or metabolic disturbances occur, often associated with deficiencies in pastures or other feeds. If the control of animal disease could be organized on a worldwide basis, we could increase enormously the amount of dairy and meat products available for human consumption. It is difficult to estimate the loss in human food due to preventable diseases in animals, but it must run into millions of tons per annum."

The suggestion was made that in addition to considering technical problems the Congress should consider ways and means of bringing about greater unity in the veterinary service of different countries and how best the research services of the better equipped countries can assist those that are poorly equipped and in most need of the application of veterinary science. By such international coöperation in applying science for the benefit of the people of all countries, governments may become less obsessed with political conflicts and more inclined to work together for their mutual advantage to create a world of plenty. Scientists and professional men, who know what modern science can do, if applied on a world scale, should urge governments to coöperate in constructive measures, which can be kept out of the area of political conflict. Such international coöperation can be an important step to a world of unity, prosperity, and peace.

It was suggested further that the veterinary profession should develop a strong international organization on the lines of the World Health Organization of United Nations through which governments could coöperate more actively in the elimination of diseases of animals on a world scale.

Scope of the Program

Other addresses (one each day) at the plenary or general sessions of the Congress were: The Veterinary Profession's Contribution to the World's Milk Supply by Prof. H. C. Bendixen, The Veterinary Profession's Contribution to the World's Meat Supply by Dr. C. S. M. Hopkirk, The Veterinary Profession's Contribution to the World's Poultry and Egg Supply by Dr. J. R. Beach (University of California), The Veterinarian and the Breeding and Rearing of Animals by Prof. N. Lagerlof, and Veterinary Education and Its Application to World Problems by Dr. W. R. Wooldridge, Scientific Director of the Animal Trust. The limitations of available space preclude any discussion of these formal addresses at this time. The discussions at the Congress will make a large printed volume and obviously even to publish abstracts of them in a periodical will take a number of issues.

Officials of the Congress

The election of officers at the opening of the 14th International Congress resulted in the selection of Sir Daniel Cabot, formerly Chief Veterinary Officer of the (British) Ministry of Agriculture, for president; Dr. W. R. Wooldridge for general secretary, and Mr. G. N. Gould, M.R.C.V.S., for honorary treasurer.

Professor G. Guérin, Director of the Pasteur Institute, Paris; Professor L. DeBlieck, Utrecht, Netherland, Secretary of the Permanent Committee of the International Veterinary Congress; Professor E. Leclainche, former Directeur, Office Internationale des Epizoötics,

Paris; Dr. P. J. du Toit, former Director of Veterinary Services and Animal Industry, Union of South Africa; Dr. John R. Mohler, former Chief of the Bureau of Animal Industry, U. S. Department of Agriculture; Dr. Josef Marek, co-author of "Hutyra, Marek and Manniger"; Col. Max Henry, head of the veterinary service of New South Wales, Australia; and Prof. Hilding Magnusson, former Director, Bacteriological Laboratory, Malmoe, Sweden, were elected honorary presidents of the Congress.

Honorary vice-presidents elected were: Professor T. Dalling, Chief Veterinary Officer, Ministry of Agriculture and President of the Royal College of Veterinary Surgeons; Professor J. Basil Buxton, Principal, the Royal Veterinary College (London) and treasurer of the R.C.V.S., and Dr. R. F. Montgomerie, president of the National Veterinary Medical Association (of Britain).

President's Address

Upon accepting the office of president, Sir Daniel Cabot addressed the Congress briefly; saying in part: "In the 11 years that have elapsed since the last International Veterinary Congress was held in Switzerland, remarkable advances have been made in all branches of science, including veterinary science, which, in addition to developments of a purely veterinary character and application, has derived inspiration and aid by discoveries in allied spheres. Among the outstanding developments of the past decade are: the application in general practice of the drugs of the sulfonamide group; the use of penicillin and the promise of newer antibiotic preparations; the new parasiticides—phenothiazine and for the destruction of external parasites; the introduction of antricide—the latest weapon against trypanosomiasis; the development of effective vaccines for the immunization of animals against foot-and-mouth disease; the widely extended use of Brucella strain 19 for the protection of cattle against brucellosis; the extensive employment of artificial insemination; the advances in research in rinderpest, including the artificial cultivation of the virus and also its adaptation to rapid progress, full of promise, in campaigns for the eradication of the most serious menace to the cattle industry.

"Partly as a result of the world war and partly as a result of other causes, the human race faces a deficiency in the supply of foodstuffs, particularly food of animal origin. The agricultural industry and the veterinary profession know full well that one of the limiting factors to output of a wide range of animal products needful to man—meat, milk, and dairy products, poultry and eggs—is the prevalence of disease.

"Consequently the Organizing Committee for this Congress has prepared an agenda directed chiefly to those conditions which most seriously limit the production of food for man. By pooling our knowledge and our experience we shall contribute toward the solution of one of the most pressing problems of the day, and at the same time improve the economic condition of the livestock industry.

Officers of the Royal College of Veterinary Surgeons. Left to right: Mr. Howard Dawes, v-pres., Prof. J. Basil Buxton, treas., Prof. T. Dalling, pres., Counselor W. G. R. Oates, sec., and mace-bearer.

"The scope of the agenda for this Congress is even wider for it touches upon questions of diseases transmissible from animals to man—public health. And let us not overlook the humanitarian side of our work. We deplore the infliction of cruelty—often a result of ignorance. We applaud the advances in anesthesia and medicine for the relief of pain. It is not always recognized that the control or elimination of disease means a reduction in the suffering among animals.

"Thus we impose upon ourselves the obligation to increase the well being of animals that their production may be of greater benefit to mankind.

"On behalf of the British veterinarians I offer a most cordial welcome to all those who have come from overseas. We thank you for your presence; we are delighted to have you with us and we shall do all we can to make your visit interesting and memorable."*

Responses to the Welcome to London

Responses to the president's welcome to the Congress were made by Dr. B. T. Sims, Chief of the Bureau of Animal Industry (U.S.A.)

*The foregoing excerpts from President Cabot's address are from *The Veterinary Record*, August 13, 1949.

for the English-speaking members, by Prof. Jean Verge, of the National Veterinary School of Alfort, for the French-speaking members, and by Prof. G. Flückiger, Chief of the Veterinary Service of Switzerland, who responded for the members who spoke German.

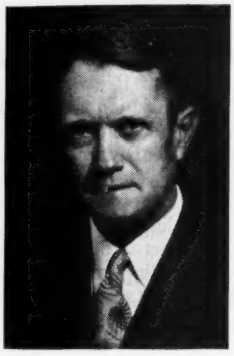
Dr. Sims said in part: "The English-speaking members of the Congress come from every corner of the world and it is an honor and privilege to represent them. We are very glad to meet and discuss with confréres from all parts of the globe the many problems that confront us, particularly the problem of food.

"In considering the problem of food and food production there are certain axiomatic truths which should be taken into account: (1) without a veterinary service there can be no economic or abundant production of animals or of foods of animal origin, (2) without economic and abundant production of animals there can be neither preservation of the fertility of our soils nor satisfactory nutritional standards for our populations, and (3) except there be permanency of the soils and well-nourished populations we cannot have an enduring civilization. In coming to this Congress veterinarians bear with them the serious responsibility of doing their part in the production of foods and finally in the preservation of civilization. We are, therefore, appreciative of the opportunity this Congress affords to meet with groups from all sections of the earth to discuss these matters which are so important for the maintenance of our civilization."

Honors for Distinguished Veterinarians

As mentioned previously plenary sessions of the Congress were held each forenoon, Monday through Saturday. Sectional meetings were held in the afternoons, Monday through Thursday. The annual meeting of the National Veterinary Medical Association convened on Friday afternoon and extended through the following Monday.

Immediately after the close of plenary session of the Congress on Friday, President Dalling of the Royal College of Veterinary Surgeons, supported by the other officers of the R.C.V.S., Howard Dawes, vice-president, Counselor W. G. R. Oates, general secretary, and J. Basil Buxton, treasurer, conferred the diploma of Honorary Associate of the R.C.V.S. upon 15 distinguished veterinarians from overseas, including three from the U.S.A.—General R. A. Kelser, Dean W. A. Hagan and Dr. B. T. Sims—and two from Canada—Dean A. L. McNabb and Dr. C. A. Mitchell.



Dr. B. T. Sims

Gen. R. A. Kelser

Dean W. A. Hagan

Entertainment

The social features of this Congress were probably not equalled at any preceding I.V.C. They included a reception by the president, Prof. T. Dalling, and the Council of the R.C.V.S., the I.V.C. banquet, the Government banquet to official delegates to the Congress, the reception by the president, Dr. R. F. Montgomerie, and the Council of the N.V.M.A., the British Veterinary Journal dinner, the Central Veterinary Society's luncheon, the dinner for overseas women veterinarians, visits to the Royal Veterinary College, to the Ministry of Agriculture Laboratories at Weybridge and to many other places and institutions of interest. Perhaps there will be an opportunity to mention them later in more detail in another connection.

Sweden Next

At the final plenary session of the Congress, it was decided to hold the next Congress, the 15th International Veterinary Congress, in Stockholm, Sweden, in 1953.

Fourteen resolutions were adopted at this session, among them recommendations:

1. That prophylaxis of animal tuberculosis be included in the agenda of the next congress.
2. That all countries endeavor to effect efficient control of bovine mastitis.
3. That efforts be made by all possible means to eradicate brucellosis and that vaccination be employed as a first step until test and slaughter become practicable.
4. That all national veterinary organizations be asked to contribute to the financial support of the international veterinary congresses.
5. That veterinary colleges be provided with increased facilities for research and instruction in the physiology and pathology of reproduction in animals.
6. That all governments take active measures for the control and eventual eradication of rabies.

All who attended the Congress were enthusiastic in their praise of the arrangements and management. The many information services, the large number of interpreters, the simultaneous translation of speeches and papers, and, in general, the smooth working of the Congress received unstinted praise.—D.M.C.

▼ ▼ ▼

Treatment of Blackleg

In a review of a series of outbreaks of blackleg on farms in New York State *(Cornell Vet.,* 39:249, (July), 1949), F. H. Fox and I. J. Roberts report encouraging results in the treatment (21 cases) of blackleg in cattle by a combination generally consisting of anti-blackleg serum, penicillin, and sulfamethazine or sulfamerazine. Penicillin was used alone in a few cases with good results.

In one group of three calves, treatment consisted of 150 to 350cc of merameth solution (5% sodium sulfamethazine and 5% sodium sulfamerazine) intravenously, and 10 to 30gm of sulfamethazine orally for the next three days. In addition 500,000 units of penicillin (Romansky formula) was given intramuscularly twice daily for five days. All recovered completely; two individuals developed large abscesses in the involved regions.

In some of the cases reported, positive post-mortem diagnosis of blackleg was made of losses in the herd. Treated animals in most of the cases reported exhibited clinical symptoms of the disease.

▼ ▼ ▼

A cow that produces 8000 pounds of milk a year secretes twice as much dry matter in the milk produced as is contained in her entire body.—J. K. Loosh.

Give to Your Community Chest

▼ ▼ ▼

Nutritional Conference for Illinois Veterinarians

The first statewide Nutritional Conference for Veterinarians, sponsored by the Illinois Feed Association and the Illinois State Veterinarians' Medical Association at Peoria, on September 1, exceeded all expectations for attendance and interest. Total registration was 196, of whom 130 were veterinarians.

The increased interest of veterinarians in livestock feeds and feeding forecasts the trend toward the universal effort to derive maximum efficiency from our feeding practices. Livestock growers and feeders are referring many complex problems of nutrition to their veterinarians.

▼ ▼ ▼

Parasites as Intermediate Hosts of Infectious Disease

The role of helminth parasites of domestic animals as intermediate hosts for infectious diseases of specific parasitized animals is discussed by Richard E. Shope *(Proc. Amer. Phil. Soc.,* 92 (4):289, 1948).

This unfamiliar mechanism of disease transmission may be of much greater significance than generally understood. The author cites three diseases in which parasites now serve as intermediate hosts, as follows: The embryonated eggs of the nematode of poultry, *Heterakis gallinae,* for the protozoan parasite, *Histomonas meleagridis,* etiological agent of blackhead in turkeys; the fluke, *Nanophyetus salmineola,* which harbors the unknown principle causing salmon poisoning; and the lungworm of swine, *Metastrongylus elongatus,* which serves as a reservoir for the swine influenza virus.

It is probable that other parasites serve an intermediate host role, multiplying potential dangers as a direct result of parasitism.

▼ ▼ ▼

In cases of brucellosis in man, causative organisms may be observed in all body tissues and blood.

Bovine Nutrition and Trace Minerals*

By Gustav Bohstedt**, Ph.D.
Madison, Wisconsin

DURING recent years, much has been made of rumen digestion and rumen synthesis to the extent that we may need to consider the limitations of this really remarkable digestive organ of cattle, sheep and other ruminants. Thus, in a discussion of the value of ground corncobs recently, one enthusiast made it appear as if ground corncobs were worth very nearly as much as ground corn itself, or were worth at least 75% as much as corn. But as a check to our enthusiasm in this respect we have the results of steer feeding trials at Iowa State College last winter where ground corncobs proved a valuable feed, to be sure, but nothing like representing a 75% or even a 50% relative value to corn grain.

To be sure, ground corncobs have fitted in well as feed for helping carry beef cows or stocker steers through the winter, or getting yearling or two-year-old steers well started on their fattening period. But if used in liberal amounts in rations of baby beeves, or carrying fattening cattle right up to a necessary good market condition, ground corncobs were worth no more than poor quality hay. Let us keep in mind that as a steer fattens, digestive capacity declines in relation to live weight. In other words, the valuable space in the stomachs and intestines of fattening steers should then be occupied for the most part by highly concentrated feeds like corn and oil meal rather than by a high fiber feed like corncobs, cottonseed hulls, straw, or low grade hay.

Rumen Organisms Need Their Own Balanced Rations

These roughages mentioned are all high in fiber or cellulose and therefore are low in energy or productive nutritional properties. They are also low in protein, essential minerals and vitamins. Unless these essential principles are supplied, even the famed rumen of a cow or steer is up against it for making use of fibrous feeds. Rumen organisms, the bacteria, protozoa, actinomyces, and other forms of life that make up the biology of the rumen, need a balanced ration of their own in order to function in the process of digestion and such activities as protein and vitamin synthesis. For one thing these organisms need a ready source of energy, and, therefore, at least a minimum amount of starch or sugar. They also need nitrogen, if not protein, and they need certain minerals, such as cobalt. Possibly they also need certain fat-soluble vitamins such as carotene. The flora of the rumen and other parts of the digestive tract probably have their own specific requirements of various nutrients of the kind mentioned. When these nutrients are available, organisms do a remarkable job digesting fiber, or cellulose, and in building up efficient proteins and apparently the whole complex of water-soluble vitamins, including vitamin B_{12}, which now is so prominently in the limelight.

Quality Hay Extremely Important

Unfortunately, the average quality of fiber feeds, especially preserved roughages, like hay and silage, is not good. Even pastures leave much to be desired.

We are told that 75% of all the milk produced in the country comes from roughages or forages, and the other 25% of the milk from the additional grain and protein concentrates that are fed. It is seen that the quality of forages fed throughout the year is of enormous importance.

Professor George M. Werner, Extension Dairy Specialist at the University of Wisconsin, during the past couple of years has kept a box score on the quality of hay and silage that was delivered by farmers to so-called hay and silage clinics at winter meetings in their respective communities. It was then the duty of Professor Werner or associates to grade these forages and to give discussions on factors that made for good or poor hay or silage. In this way some 667 samples were judged with the following result: Only five per cent of the samples submitted were excellent, 25% graded good, 45% fair, and 25% poor. Between two-thirds and three-fourths of all the hay and silage put up by farmers and dairymen of Wisconsin graded no better than fair, a large portion of it downright poor.

There is no reason to suppose that farmers in other states do a better or very much better job of making hay and silage. This means that

*Address at Nutrition Conference for Veterinarians, jointly sponsored by the Illinois Feed Association and the Illinois Veterinary Medical Association, Peoria, Illinois, September 1, 1949.

**Chairman, Dept. of Animal Husbandry, University of Wisconsin.

a good job is being done only in preserving the coarse-fibered stalks of forage crops. The loss of leaves is a loss of a large portion, or even the major part, of the fine proteins, minerals and vitamins originally a part of the plant. Properly conserved for winter use these last portions would revolutionize our American livestock management and tremendously improve the health and efficiency of animals.

Rumen Synthesis Makes Cow Manure Valuable

In the presence of essential elements, the paunch organisms of a cow have a better chance at producing a better complex of proteins or amino acids, if by chance this should be necessary. There would be more readily available energy nutrients, in such high quality forages, and still other nutrients, that the organisms may need to synthesize water-soluble vitamins. By preserving the leaves of hay, the various minerals, including the minor or trace minerals are better conserved. Surely, the bacteria in their synthesis of vitamin B_{12} need cobalt, as this cannot be obtained from thin air. Among the whole galaxy of B-complex vitamins we have the so-called APF factor, of which B_{12} is a prominent component. The complexity of the life processes or biological processes of the paunch are really tremendous. I doubt whether on posting a cow and discarding the paunch contents we are always aware of its enormous importance. A little wad of rumen content of this sort transferred to the rumen of a three-week-old calf might make a very considerable difference in the efficiency of rumen physiology of this developing young animal. Such transfer of a cow's cud to a calf has recently been made at the Ohio Experiment Station with seemingly good results. Perhaps this work is continuing and we shall hear more about it. This has raised the question of whether a calf running with its dam and licking the same materials that have been slobbered over by the cow, might not in this way get a beneficial inoculation of its paunch and thus have an advantage over a calf that is removed from the dam when only two or three days old.

What is contained in the paunch contents of cows or steers is likewise found in the cattle manure. We may expect to find there some valuable essential amino acids, water-soluble vitamins and, depending upon the quality of the forages consumed, a considerable amount of carotene and other fat-soluble vitamins. Perhaps this is why pigs following steers in the feed lot are usually thrifty. They do not miss pasture nearly as much as other pigs that are kept penned up. Among the water-soluble vitamins synthesized by the cow is vitamin C or ascorbic acid. In contrast with the other water-soluble vitamins, the B-complex vitamins, vitamin C is synthesized within the body proper rather than in the paunch or digestive tract. Whether vitamin C is synthesized primarily in the liver or in epithelial tissue including the lining of the digestive tract, its production seems to hinge in part on the carotene content or, let us say, on the quality of hay, silage or other forage that has been fed. With all her rumen assets, a cow is after all dependent upon leafy green hay or comparable grades of forage in order to be well nourished.

High Carotene Means Good Hay

High carotene content stands for high quality of hay and silage. Carotene is the single most important criterion in the grade or quality of hay. High carotene hay is almost bound to be a leafy legume hay, and therefore the most desirable kind of hay. High carotene content means that such hay has been cut early, and has been properly cured and stored. If we preserve carotene we also preserve protein and what we ordinarily refer to as the protective nutrients—these being the various minerals and vitamins. Dr. E. B. Hart, of the University of Wisconsin, has during recent years devoted most of his efforts toward the preservation of carotene in hay, especially dehydrated hay. Most of us appreciate that as alfalfa hay comes out of the dehydrator it has its moisture reduced to only about five or six per cent, being therefore a very dry product. If now this low moisture is raised to a level of about ten per cent and the hay is stored in an air-tight container, the carbon dioxide produced by some form of respiration within the hay replaces the free oxygen, in this way stopping the destruction of carotene. At least the destruction of carotene is greatly slowed down, thus resulting in a carotene-rich feed after many months of storage. This process is still in the experimental stage but the results are reassuring. They have importance in consideration of the fact that normally about half of the carotene in hay is destroyed during the first six months of storage.

Trace Minerals Are Coming to the Front

I have mentioned trace minerals and one of its members, cobalt. We consider five trace minerals as necessary to be added to many practical livestock rations, more in some sections of the country than in others. These five trace mineral elements are iodine, cobalt, manganese, copper and iron.

By way of a very brief review, we have the Great Lakes region and some of the northwest

states that are lacking in iodine; several regions of the country including Florida, also some of the northeastern states and parts of Michigan and Wisconsin are lacking in cobalt; the sand or sand-derived swamps of Florida are lacking in copper, seemingly also iron; and many livestock rations, especially poultry rations, in various parts of the country are lacking in manganese. The feeding of extra amounts of manganese to poultry has become a well-nigh universal practice. Chickens have an unusually heavy demand for manganese for purposes of early growth, for reproduction including the hatchability of eggs, and for proper bone growth and the avoidance of perosis or slipped tendon.

In recent years only iodized salt was being fed, in consideration of a possible iodine deficiency, now the other trace minerals mentioned, sometimes also including zinc, are being added to iodine to produce so-called trace mineralized salt. The trace minerals are also put in special premixes as prepared by various manufacturers. Both methods are or can be made effective and at the same time economical.

It seems obvious that if an iodine or a cobalt deficiency is found in one or the other area of a country, that iodized or cobaltized feed should be used by way of nutritional protection. Thus iodized salt to be used in formula feeds or in home-mixed rations has been used in the Great Lakes area for many years. A few years ago in Wisconsin cobalt was likewise in many cases added, in the amounts of from three-fourths to one ounce of cobalt sulphate with 100 pounds of salt. This has given protection against a cobalt deficiency in cattle, sheep or other ruminants. The picture in reference to the other trace minerals is not quite as clear, in that, with the exception of Florida, we have not experienced anywhere else such a dramatic occurrence of a copper and iron deficiency. Nor do we, with the exception of perosis in poultry, have a similar striking occurrence of manganese deficiency in farm animals. However, there have been considerable improvements in many swine and cattle rations where manganese additions have been made, and where seemingly copper and iron may likewise be beneficial.

Need Trace Minerals Be Fed Everywhere?

This raises the question of how universally the above-mentioned trace minerals should be fed. Should every stockman feed rations that are supplemented with these trace minerals? This prospect may seem somewhat forbidding.

At the same time, there are many dairymen, producers of pork and other stockmen who feel that where every few years seemingly still another trace mineral deficient area of the country is being identified, they themselves might perchance be living in a part of the country that some years hence will be found as also more or less deficient in one or the other trace mineral elements. Hence, until one knows for sure that the mineral situation is all that it should be, why not carry insurance against a trace mineral deficiency in herds and flocks?

Why not, therefore, feed rations that are fortified with trace minerals in one way or another? Feed manufacturers are availing themselves primarily of trace mineral premixes in the production of their formula feeds. There are thus well designed and economical trace mineral preparations that in specified amounts in commercial mixed feeds give protection against the several trace mineral deficiencies.

Thus a quite logical trace mineral premix for poultry is manganese plus perhaps other trace minerals incorporated in ground limestone or calcium carbonate. Poultry have a high requirement for both calcium and manganese. They may also be in need of additional iodine.

One of the significant developments during the past two years has been the production and use of trace mineralized salt. Where there were only two or three salt companies offering trace mineralized salt to the trade a year or two ago, there now appear to be a dozen or more. In other words, trace mineralized salt is coming into quite general use. It is used mostly for free choice feeding, where animals have voluntary access to it. It may be used in the same way that ordinary salt has been used all along. When properly compounded, it lends itself also as a premix in feed manufacture, thus conveying effective protection to farm animals.

Low-Cost Insurance Against Mineral Deficiencies

This still leaves unanswered the question of whether such fortified feed or fortified salt should be used everywhere. I mentioned the factor of insurance. It is readily understood that the purchase of insurance may be widespread if the rates or the premiums are low. In the case of trace minerals, whether conveyed to the feed by special premixes or by trace mineralized salt, the rates are or can indeed be quite low.

Thus, considering the price differential between plain salt and trace mineralized salt, a ton of cow feed can be effectively trace-miner-

(Continued on Page XXVI)

Comments Upon Animal Health Factors

By R. R. DYKSTRA, D.V.M., Manhattan, Kansas

Recently an inquiry received from an anxious mother raised the question of preventing cats from soiling the children's sand-pile. Regretfully we informed her that we know of no other means than to get rid of the cats or the sand-pile. Furthermore, we wrote her that from our parasitologist, Dr. R. L. Jewell, we have learned that cats and dogs infected with a hookworm, *Ancylostoma braziliense,* pass the eggs of this parasite with the feces, to develop later into the larval form, and the latter, upon establishing a contact, may penetrate the skin of children to set up a severe dermatitis. Since man is not the host for this mature parasite, the larvae die in their subcutaneous human abode, but they are very annoying and irritating during their temporary existence under the human skin. In other words, don't mix children and sand-piles when the latter are contaminated with the feces of cats or dogs.

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Kerr, Lamont and McGirr in the *Veterinary Record* of August 6, 1949, indicate that in testing cattle for tuberculosis, the Stormont test is more accurate than the single intradermal test for the detection of all forms of bovine tuberculosis, with the exception of the so-called skin form in which the Stormont test was no more nor less accurate than the older tests. The Stormont test technic is based on the observation that in the tuberculous bovine, an intradermal tuberculin injection site exhibited increased sensitivity to a second tuberculin injection given seven days after the primary inoculation.

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Reports from various sources have in the past indicated that in many sections of Africa man has been squeezed into smaller and smaller areas because of inroads by the tsetse fly and other biting flies. These flies serve as vectors to transmit the trypanosomiasis from big game reservoirs (this fauna normally harbors the trypanosome without being harmed by it), to susceptible man and his domesticated animals. Clearing breeding places of the flies, mostly members of the genus Glossina, by destruction of brush and thickets, the destruction of wild game, the use of specific drugs to destroy the trypanosome in the living body, and spraying of DDT and gammexane by means of airplanes, are the approved methods of attack.

Michigan Technical Bulletin, No. 211, carries the information that swine, when offered a comparatively highly relished grain ration, plus the relatively less palatable protein (the latter presumed to contain the B-vitamin complex factors niacin, riboflavin, and pantothenic acid, etc.) turned to the cereal and neglected the protein so that the latter constituted less than a total protein content of 14% in the ration, and severe nutrition-enteritis resulted. Intraperitoneal injections of the B-vitamin complex, and supplementing the feed with the same vitamin, resulted in 86% recoveries from this form of enteritis.

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Swine ascarid ova in the uteri of this parasite—the latter eliminated with the feces of swine as a sequence to the addition of 1% of sodium fluoride to a ration of ground feed for one day, were not adversely affected.

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Iowa human brucellosis statistics indicate that 75% of infected patients had direct contact with animals. Of this group 87.7% were males, though in a smaller group of human patients that did not have animal contacts the infected persons were equally divided between the sexes. Veterinarians had the highest morbidity. This study involved 2000 separate case reports.

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Saphir and Miller, *(Jour. Am. Vet. Med. Assn.,* July 2, 1949), report on the case of a woman infected with the virus of western equine encephalomyelitis, and its successful treatment with gamma globulin containing specific neutralizing bodies in high titer. Intramuscular injection of 10cc doses daily was given for seven days.

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The prevention of milk-fever, according to many practitioners, in those cows which have had one or more attacks, rests to a large extent in removing the milk of a recently freshened animal at about the same rate that a calf would remove it in natural nursing; a little every two hours the first day—never emptying the quarters completely, and gradually during the next ten days decreasing the number of daily milkings and at the same time increasing the amount removed at each milking.

Why Cows Fail to Conceive When Bred By Artificial Insemination*

By GLYNDEN T. EASLEY,** B.S., A.M., D.V.M.
Sulphur, Oklahoma

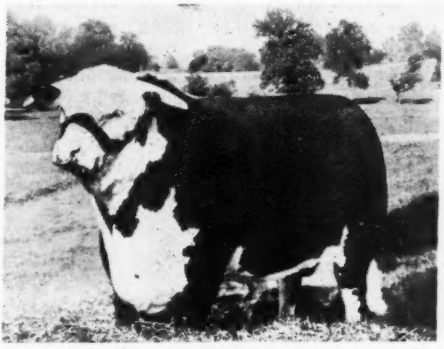
WITH the development of artificial insemination and its widespread use, a great deal of attention has been focused on conception rate following the practice. With the many opportunities afforded by artificial insemination to study conception rate, numerous interesting observations and some real progress have resulted. For the first time, it has been possible to differentiate influences for which the male is responsible from those for which the female is responsible in the determination of the rate of conception. The subject may be objectively divided into four general sections for the purpose of discussion. They are: (1) general conditions influencing conception in the bovine female, (2) factors affecting the production of normal semen in the bull, (3) collection and processing of the semen and insemination and (4) factors related only to the cow.

This is too broad a subject to attempt to cover in a short discussion. It shall be the purpose of this paper to cover briefly only some of the factors of primary importance to veterinarians.

General Conditions Influencing Conception

Health. Reproduction is one of the normal body functions and, like all other body functions, is most efficient in animals that are in an optimum state of health. Extremely thin or emaciated animals are abnormal individuals, as are extremely fat animals. With excessive fat there is mechanical impairment of exercise, circulation, respiration, peristalsis, a slight increase in body temperature and hypofunction of the endocrine glands. Such fat condition of either sire or dam directly reduces conception rate. Literature is replete with reports on the influence of minerals, vitamins and proper nutrition upon reproductive efficiency. The harmful effects of brucellosis, trichomoniasis and vibrioiasis, is common knowledge to the veterinary practitioner. A lower conception rate is usually noted in herds in which the incidence of mastitis, foot rot, digestive disturbances, actinomycosis, etc., is high. Heavy parasitism, either internal or external, is responsible for debilitation and has a direct influence on normal reproduction.

Season. Several workers have reported a seasonal variation in conception rate. In dairy cattle in Michigan and New York the highest conception rate is reported to be in the early spring and fall. With Herefords in Arizona, the most favorable conception rate occurs in July and August. This variation may be of nutritional or endocrine origin, or both. In most herds, there is a definite seasonal variation in nutrition. As for the endocrine variation, this may be alteration of activity of the thyroid gland due to seasonal temperature changes or from the anterior pituitary gland by the influence of the length of daylight, a seasonal factor. Some recent reports indicate a much higher level of certain sex hormones in young growing succulent plants in the spring. It is conceivable that this might exert some influence on conception rate.



Hazford Rupert 81st, Champion bull at the International Livestock Exposition, Chicago, 1936, and The American Royal Livestock Show, Kansas City, 1937. This fine bull sired approximately 675 calves, 307 of which were sold from Turner Ranch for over one-half million dollars. He was stifled at the age of eleven and was never able to serve a cow again, yet by the use of artificial insemination he sired 100 calves during an eleven-month period shortly before his death.

Breed. There is a noticeable variation in the rate of conception among different breeds of cattle. Pregnancies resulting from artificial

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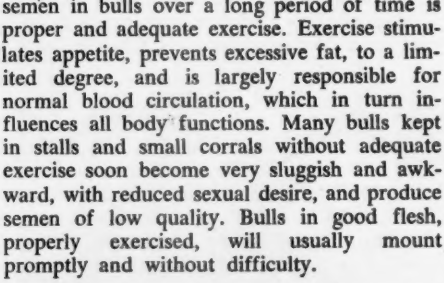
**Veterinarian, Turner Ranch.

insemination in beef cattle seem to be somewhat more regular than in dairy cattle. It is probable that more selection is practiced generally for insemination of beef animals. Beef cattle production is measured by the percentage calf crop, while in dairy cattle practice, more emphasis is placed on milk and butterfat production.

According to research reports a five to ten per cent lower conception rate is observel in Guernsey cattle, compared to other dairy breeds. The production of lower quality semen has been noted in most Guernsey bulls.

Factors Affecting the Production of Normal Semen in the Bull

Exercise. The most important factor in maintaining the production of high quality semen in bulls over a long period of time is proper and adequate exercise. Exercise stimulates appetite, prevents excessive fat, to a limited degree, and is largely responsible for normal blood circulation, which in turn influences all body functions. Many bulls kept in stalls and small corrals without adequate exercise soon become very sluggish and awkward, with reduced sexual desire, and produce semen of low quality. Bulls in good flesh, properly exercised, will usually mount promptly and without difficulty.



Tcaldo Rupert, son of Hazford Rupert 81st, age 6, getting his exercise in his three acre lot. Note the double fence and the cows in the background. This shows the extreme heavy condition a bull may carry, even with adequate exercise, and still produce semen of high quality. With the exception of the months of October and November of 1947 and 1948, semen has been collected twice weekly from this bull since April of 1946.

A preferred arrangement to stimulate exercise is to place the bull in a small double fenced pasture or trap that is surrounded by lots in which cows may be pastured. As the cows come near the trap, the bull will walk the fence in an attempt to get to them. Soon he forms a well beaten path inside the trap. This exercise approaches the natural and has proved an ideal method in our experience of encouraging exercise in bulls.

If there is a large number of mature males and space is limited, then forced exercise should be used. Usually one or two hours every other day on a forced exerciser, walking at the rate of three or four miles per hour, is adequate.

Condition. Within reasonable limits, condition has very little influence on the quality of semen. In some beef bulls as they mature on heavy rations, there is a tendency to lay on fat in the scrotum and adjacent regions. Such fat deposits appear to have a detrimental effect on the quality of semen. With an increase in exercise and reduced rations this condition usually can be corrected.

Increased body temperature. Infections, violent exercise, or high climatic temperatures may increase body temperature sufficiently to be a factor influencing quality of semen. The normal temperature of the testicle is one to two degrees below that of the body. This is as nature intended for proper spermatogenesis. An increase of one or two degrees in testicular temperature immediately stops spermatogenesis and destroys many of the developing sperm. Ordinarily, within one to two weeks, such a change will be reflected on microscopic examination of a semen specimen. With a return to normal temperature, providing the damage is not excessive, normal spermatogenesis is resumed. In the south during the mid-summer months this condition is observed especially in the heavy breeds. Any infection that results in a marked increase in body temperature of a bull lasting for a few hours or more, will be reflected in the semen quality and in the conception rate.

Frequency of use. Spermatogenesis is a continuous process that is rather constant in the bull. If sperm are delivered at a more rapid rate than they are produced, there is soon a decrease in the volume of ejacula and sperm concentration with an increase in number of immature sperm and a marked decline in the conception rate obtained. Where artificial insemination is practiced, most authorities recommend that the interval between semen collections, in dairy bulls, be seven to ten days, especially if the bull is to be used over a period of several years. Semen may be taken twice each week over a period of years from Hereford bulls, which have passed 18 months of age, and still prove to be satisfactory in quality. The work with Herefords in Arizona showed an increase in conception rate from 63% where semen was collected daily to 82% where

the interval between collections was ten days.

There is definitely an individual and breed variation in the frequency with which semen may be collected from bulls and still maintain a quality that will impregnate a high percentage of cows. The best index in determining the frequency with which any individual bull may be ejaculated is the quality of semen being produced and the conception rate resulting from its use.

Excitement of the bull, and number of ejaculates collected. In many studs, two ejaculates are taken from each bull routinely, the second immediately following the first. Some workers have reported an improvement in the quality of the second ejaculate. Improved semen quality is influenced by the excitement of the bull and preparedness before service. When a bull is taken from the stall and permitted to serve immediately with little time for preparation, a small volume of rather poor quality semen is obtained. If the bull is led up to the cow to be served and taken away once or twice, or permitted to mount without service, excitement will be increased and time allowed for the bull to prepare for service. Usually a higher quality of semen is produced and only one ejaculation is necessary. With excitement and preparedness, the first ejaculate in Hereford bulls is almost always of higher quality than the second. The improvement in the quality of semen collected following preparedness and excitement of the bull is accounted for by the flushing of the urethra removing any traces of urine and harmful secretions or the adjustment in the relative amount of accessory secretion during ejaculation or both.

Age. In the normal bull, high quality semen is ordinarly produced shortly after sexual maturity and under proper management remains high until senile changes develop. The semen of young bulls just coming into sexual maturity is usually of low quality and will not produce a normal conception rate. In the young males, spermatogenesis seems to be slower and semen collections should not be made as frequently as in older bulls. The maximum semen production is probably reached at four or five years of age. Senility in bulls is usually rather sudden and is marked by almost complete cessation of spermatogenesis with concurrent atrophy of the testicles.

Cleaning the bull. Although very little work has been done to show the effects of bacterial contamination of semen on conception rate, it is reasonable to believe that certain types of bacteria or high concentrations of foreign material in the semen reduce the percentage of females impregnated. The Cornell workers demonstrated a ten to 100-fold decrease in the bacterial count of semen samples taken from bulls after scrubbing the under line and flushing the sheath with sterile water. In old bulls, where the secretions and activity of the penis are reduced, flushing of the sheath becomes of greater importance.

All of the above mentioned factors influence the quality of semen produced by bulls. In order to maintain a high conception rate, good quality semen is necessary. Experience has shown that the rate of conception varies directly with volume of the ejaculate, sperm concentration and total number of sperm per ejaculate. A normal mature bull should ejaculate 5cc to 6cc of semen with a sperm concentration of 1,000,000 per cubic millimeter or more having a motility rating of five and less than 20% abnormal sperm.

Collection and Processing of the Semen and Insemination

Semen collection. Where high quality semen is desired over a long period of time, collection with the artificial vagina is usually the method of choice. Normal ejaculates that are free from contamination can be collected consistently. In using the artificial vagina, care should be taken to see that glassware and rubber that come in contact with the semen are free from bacterial contamination or any foreign material harmful to the spermatozoa. Any sudden temperature change of the semen, such as contact with an excessively warm rubber liner or collection in a cold vial, should be avoided.

Semen may be taken from the vagina of the cow after service, but it is always contaminated with vaginal secretions and the organisms present in the vagina.

In some cases, semen may be obtained by rectal massage. Usually such semen is abnormal. It is very difficult to collect high quality semen and obtain a satisfactory conception rate over a long period of time when collected by rectal massage.

Processing semen. In processing semen, it should be remembered that sperm cells are very sensitive to exposure, abnormally high temperatures, rapid cooling, exposure to sunlight, vigorous agitation, contamination and any change in osmotic pressure or pH.

As soon as possible after collection, the semen should be prepared for storage and cooling begun. Ordinarily one of the egg yolk diluters prepared under aseptic conditions and using eggs from a pullorum-free flock, should

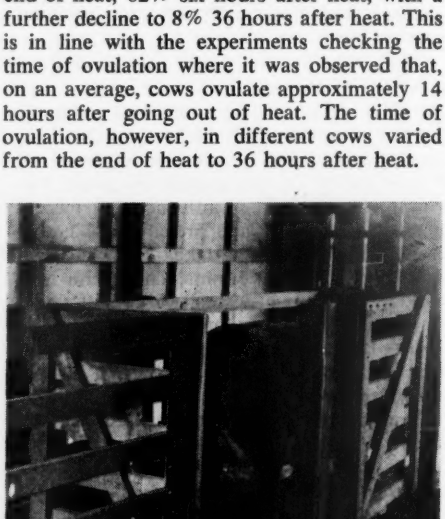
be used. Care should be taken to see that the temperature of the semen and diluter are approximately the same when mixed. In some sections of the United States most samples of semen can be stored successfully undiluted. However, in areas of several thousand feet altitude, one of the yolk diluters is required for successful storage. Diluted semen may be cooled to storage temperature, 40°F., within 30 minutes with no harmful effects. The cooling time for undiluted semen should be one and one-half to two hours. It must be kept in mind that even room temperatures sustain high sperm activity and subsequent exhaustion of energy supply. Ordinarily a satisfactory rate of conception can be maintained with semen stored up to three or four days. A decline of ten to 20% in rate each day thereafter should be expected.

Method of Insemination. Three methods of insemination have been used; vaginal, cervical, and intrauterine. With vaginal insemination, the pipette is introduced into the anterior portion of the vagina and the semen expelled. A speculum is usually used for cervical insemination and the semen is deposited in the os uteri or posterior portion of the cervix. For intrauterine insemination, one hand is introduced into the rectum, grasping the cervix, while the pipette is directed into the uterus and the semen expelled. Experiments have shown an increase in conception rate of five to ten per cent with intrauterine insemination, compared to cervical insemination, or 20 to 40% increase compared to vaginal insemination. It has been suggested that harmful organisms might be introduced into the uterus by intrauterine insemination. This is possible; however, where proper precautions and good technic are used, there seems to be no danger.

Factors Related Only to the Cow

Estrus, ovulation, fertilization and implantation are intricate processes that require almost perfect synchronization of many physiologic functions to obtain a high degree of efficiency. Then the first requirement in obtaining a high conception rate is a physiologically, anatomically and histologically normal reproductive tract.

Time of insemination in relation to heat and ovulation. To obtain best results, ovulation and insemination must be properly timed. It has been demonstrated that after ovulation, the ovum in its migration down the fallopian tube acquires, in a very few hours, a resistant coating that prohibits fertilization. Viable sperm cells must be present in the anterior portion of the fallopian tube at the time of ovulation. Approximately five hours are required for sperm to reach the anterior portion of the fallopian tube. They retain their fertilizing ability for about six hours in the tubes. Nebraska workers reported a conception rate of 44% in cows inseminated at the beginning of heat, 82% at the middle of heat, 75% at the end of heat, 62% six hours after heat, with a further decline to 8% 36 hours after heat. This is in line with the experiments checking the time of ovulation where it was observed that, on an average, cows ovulate approximately 14 hours after going out of heat. The time of ovulation, however, in different cows varied from the end of heat to 36 hours after heat.



Cow ready for insemination. Note the side gate which allows the inseminator to step in behind the cow and close the chute behind.

Interval from calving. Following parturition, a great deal of change and repair must be brought about in the reproductive tract and endocrine system to prepare for another pregnancy. The uterus must undergo involution from a diameter of one or two feet to one or two inches. The placenta, which during pregnancy becomes the most powerful endocrine gland of the body, is gone, thus requiring the body to set up a new endocrine balance and establish its normal rhythm. These processes require several weeks. Many cows come in heat 20 to 40 days following parturition. Ordinarily this is not sufficient time to recover from the previous pregnancy and if inseminated at this first heat period, the pregnancy rate will be low and the percentage of abnormal pregnancies in those that conceive will be much higher than average. Experimental work shows an increase in conception rate with an increase in the interval from previous calv-

ing up to five or six months. It is generally to be recommended that cows have a minimum of 45 to 60 days' rest between pregnancies.

Age. There is a slight improvement in the conception rate in cows up to five or six years of age. With increased age, there is a slight decline until marked senile changes begin. The rate then drops rapidly.

Violent exercise and excitement. Cows that are inseminated while fatigued or hot and excited, seldom conceive. These cows should be allowed to rest and remain quiet until the body temperature returns to normal and they have recovered and rested, before being inseminated.

Anatomical abnormalities. The most common anatomical abnormalities are those resulting from infection and injury during parturition. These include fibrosis, large areas of scar tissue, adhesions, absence of cotyledens, occlusion of the tubes, paralysis of the reproductive tract, eversion of the cervix, breaking down of supporting uterine ligaments and a weakness in the wall of the vagina.

Other abnormalities are occasionally encountered, such as an atonic condition of the uterus, malposition over the brim of the pelvis, presence of vaginal or ovarian cysts, or abnormal conditions, such as underdevelopment of some portion or organ of the reproductive system.

Many of these conditions render the cow hopelessly sterile and all bring about some reduction in conception rate. Fortunately, the incidence of these conditions is relatively low and most cases can be detected on thorough examination.

Infection. Many of the infections of the reproductive tract are easily diagnosed by the presence of exudates, swelling, inflammation, increased temperature, scar tissue and abnormal tone. Cows showing marked signs of infection usually do not conceive and should not be inseminated until the infection is controlled and the reproductive tract returned to normal. Some recent work indicates that low grade infections which are not ordinarily diagnosed, markedly reduce conception rate. Bacteriological cultures of the uterus of slaughtered cows that were apparently normal, but failed to conceive, has revealed a mild metritis. Several workers have reported successful insemination in such cows following intrauterine penicillin therapy. On the Turner Ranch, combined penicillin and sulfonamide intrauterine therapy in cows that were apparently normal but failed to conceive after several services, has resulted in a normal rate of pregnancies.

Endocrine balance. The endocrine balance of the body undergoes a constant change from birth to death and it is this shifting in the relative hormone levels that brings about growth, development, maturity and senility. It seems only reasonable, then, to believe that somewhere along the way there is a certain threshold level or balance that is optimum for reproduction and any deviation from this, either way, would result in a lowered conception rate. The intricate processes which make conception possible are brought about by the action of various hormones. Cows given a therapeutic dose of stilbesterol a few days after insemination seldom conceive. Conception can be prevented by expelling the corpus luteum eight to ten days following insemination. Nymphomaniac cows, and those that have abnormally short estrual cycles due primarily to ovarian cysts, will not conceive but usually respond to hormone therapy and will then conceive. In cases where no corpus luteum develops or only partially develops following estrus, another estrual period can be expected in seven to 14 days. Proper hormone therapy will usually result in a normal estrual cycle and conception can be obtained. To a very large extent, the resistance to infection and ability to combat infection in the reproductive tract is regulated by the presence of certain hormones. Liberation of the female sex hormones into the blood stream enhances the action of all of the natural disease-combating mechanisms and processes in the reproductive tract by increasing the blood supply, instigating an infiltration of leucocytes, stimulating secretions which are bacteriastatic and germicidal, and initiating motility which might expel any exudate present.

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Synthetic Cortisone

Considering the dire need of a satisfactory treatment for rheumatoid arthritis, it is likely that successful synthesis of cortisone and the adrenocorticotrophic hormone (ACTH) will be announced one of these fine days. It is understood that the synthesis of these hormones is extremely complex and difficult but only by manufacture of them can we hope for quantities sufficient for extensive trials and use for the relief of arthritic symptoms. Production from natural sources is entirely inadequate.

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Rubella (German measles), a comparatively harmless disease to a person suffering an attack, causes damaging defects to the eyes, ears and heart of the human fetus when the mother contracts the disease during the first three months of pregnancy.—S.N.L.

Notes on Veterinary Parasitology

By A. O. FOSTER, B.A., M.A., Sc.D., Beltsville, Maryland

New Treatments for Dog Heartworms

The dog, as well as man, has benefited from wartime research on antifilarial drugs. It is already apparent, moreover, that some of the new drugs are useful for treating more than one parasitic infection, and it is possible that one or more of them will find many applications in the livestock field.

Developments in the treatment of filarial infection are an absorbing chapter, but too long and involved for our present consideration. No account would be complete, however, without reference to caparside and caricide. As of today, the former appears to be the drug of choice for the treatment of heartworm infection of dogs. The neutral sodium salt is marketed by Abbott Laboratories, and full information on its use is conveyed in descriptive literature. The latter is available from Lederle Laboratories, which also provides full information in accompanying literature. It is interesting to note that, as of today, this compound (under the trade-name hetrazan in the human field) appears to be the drug of choice for the treatment of Bancroft's filariasis in man. Notwithstanding these expressions of opinion, both drugs are used for dogs, as well as man and comparative studies are still in progress in both fields.

Until the discovery of these drugs, trivalent antimony compounds were widely used in nearly all forms of filarial infection. Such compounds are reasonably efficacious in destroying microfilariae and exhibit a sterilizing effect on adult female worms. Their killing action on adult worms, however, is slow and uncertain. When wartime research was initiated, studies conducted at the National Institutes of Health (U.S. Pub. Hlth. Service), suggested that such remedies as fuadin, stibsol, and tartar emetic might be replaced by other, more efficacious trivalent antimonials. With further studies in many parts of the country, however, interest shifted rapidly to the pentavalent compounds, notably neostibosan and neostam, then to certain nonmetallic compounds. Caricide (syn. hetrazan, 84L) is the most promising and best known drug of this last-named group. It was developed by R. I. Hewitt and associates at Lederle Laboratories. Chemically, it is 1-diethylcarbamyl-4-methylpiperazine hydrochloride.

In consequence of studies by G. F. Otto and associates at John Hopkins University[1], the organic arsenicals were brought prominently into the chemotherapy of filariasis. Arsenicals had been used many years earlier, even before the antimonials, but it was not until the work of Otto and his collaborators that the significant action of arsenicals was appreciated. Generally speaking, these compounds, in contrast to the antimonials, have a definite killing effect upon adult worms but are only slightly lethal to microfilariae. The new antifilarial arsenical developed by Otto is known by the generis name arsenamide, and the chemical name p-[bis-(carboxymethylmercapto)arsino] benzamide. The neutral sodium salt is administered intravenously. Because of the persistence of microfilariae in blood films, it is considered advantageous, in some cases, to follow caparside treatment with a course of fuadin. Caricide has the special advantages of quick action on microfilariae and easy administration *per os*. For these reasons, further studies may reveal that a combination of caparside and caricide is better than caparside followed by fuadin. Experimentally, this is worthy of trial, although there is yet no basis for recommending the combination for general use.

▼ ▼ ▼

Aureomycin in Amebiasis

In addition to actidione and streptocin (VETERINARY MEDICINE, 44:375, Sept., 1949), aureomycin appears also to possess specific action against organisms of the animal parasite group*. Three patients with clinical amebiasis, and passing both trophozoites and cysts, were given from 19 to 22.7gm of aureomycin in divided doses over a three-day period. They became asymptomatic, and six to 14 consecutive post-treatment stools were negative by fresh and stained smears, as well as cultures. Eleven additional cases are also reported to have been successfully treated. The antibiotic was found to be effective *in vitro* as well as *in vivo*.

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[1]Otto, G. F., and Maren, T. H., Use of an Arsenical Compound in the Treatment of Heartworms in Dogs. *Vet. Med.*, 42:128 (Apr.), 1947.

*McVay, L. V., Laird, R. L., and Sprunt, D. H. A Preliminary Report of the Successful Treatment of Amebiasis with Aureomycin. *Science*, 109 (2841): 590-591, June 10, 1949.

Continuous Phenothiazine Therapy for Horses

Part II. Hematological Studies with a Note on Postmortem Findings*

By M. F. HANSEN,** Ph.D., A. C. TODD,** Ph.D., and G. W. KELLEY,** B.S.

TODD *et al.*, (1949b), in the first paper of a series on continuous phenothiazine therapy for horses, (VETERINARY MEDICINE, 44:411, Oct., 1949), reviewed the history of low-level phenothiazine therapy and reported the effect of this therapy on the parasite fauna of 12 experimental horses.

Reports in the literature on toxic effects dictate prudence in the administration of therapeutic doses of phenothiazine to horses. It has been shown that a hemolytic anemia and subsequent jaundice can result from phenothiazine therapy, certain individuals appearing to be hypersensitive to the action of phenothiazine. Swales *et al.*, (1942), suggested from their studies that the smaller erythrocytes (microcytes) were more susceptible to the action of phenothiazine and/or its derivatives than were the large erythrocytes (macrocytes). Swales (1942) further suggested that in the case of horses which have a high percentage of microcytes, such as the Thoroughbred, a practical method of keeping the dose of phenothiazine low would be desirable.

Todd *et al.*, (1949a), reported most effective strongyle control in Thoroughbred mares and their foals in Central Kentucky through the use of a system of intermittent low-level phenothiazine therapy when compared with other systems of phenothiazine therapy. An investigation of possible cumulative effects of intermittent low-level therapy was, therefore, indicated.

The use of continuous low-level phenothiazine therapy involving 0.5gm daily, 1.0gm daily, 2.0gm daily, and 4.0gm daily in our experiments was a more rigorous test on the effects of low-level therapy on the blood and tissues of the horses, than the intermittent schedule of 2.0gm dose employed under field conditions. The purpose of the work reported in the present paper was to record the effect of continuous low-level phenothiazine therapy on the blood picture, and to note any accompanying histological changes in the tissues (liver, heart, lungs, kidneys and spleen).

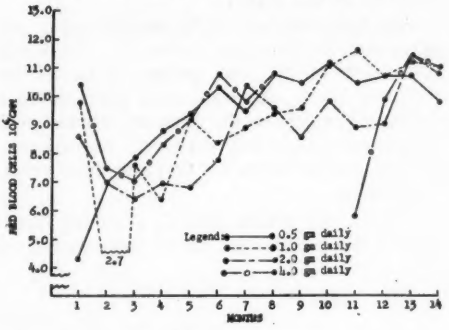

Fig. 1. Red cell counts

Methods

Twelve horses ranging in age from two to 18 years were divided into four groups. The first group received 0.5gm of phenothiazine daily and was composed of a Thoroughbred wobbler stallion, a Thoroughbred wobbler mare, and a grade mare. The second group received 1.0gm of phenothiazine daily and was composed of two Thoroughbred fillies and one grade filly. The third group received 2.0gm of phenothiazine daily and was composed of two Thoroughbred mares and one grade mare.

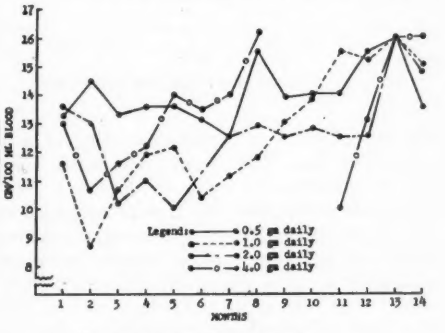

Fig. 2. Hemoglobin content

*The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.

**Department of Animal Pathology, Kentucky Agricultural Experiment Station, Lexington, Ky.

The fourth group received 4.0gm of phenothiazine daily and was composed of two grade fillies and one grade mare.

The horses were maintained almost entirely in stalls; practically no pasture was available to them. The feed consisted of hay and corn-corncob meal until July 1, 1948. After July 1, the diet consisted of hay, oats and corn.

On April 26, 1948, one horse in each of the four groups was drenched with 30.0gm of phenothiazine. On April 27, 1948, the different levels of continuous phenothiazine therapy were initiated and continued for the 52 weeks recorded in this paper.

The data reported in the present paper are those obtained from four horses, *i.e.*, one horse from each of the four groups of horses on different levels of continuous phenothiazine therapy. The data on the other eight horses will be presented when they shall have been on continuous phenothiazine for two and three years, respectively.

Prior to the senior author's assuming direction of the blood work in the third month of the experiment, no definite quantity of anticoagulant had been used, nor were blood counts consistently made in duplicate. With these two exceptions, which were corrected on the fourth month of the experiment, the technic used was as follows: Blood samples were collected between 8:00 A.M. and 9:00 A.M. every four weeks for a 52-week period. Five milliliters of blood were withdrawn from the jugular vein into a bleeding tube containing enough ammonium and potassium oxalate mixture to make a concentration of 2mg per milliliter of blood. A drop of blood remaining in the bleeding needle, which, therefore, did not contain oxalate, was placed on a clean glass slide and the differential film was made. Differential counts were based on 200 white blood cells. Hemoglobin concentrations were measured by means of the Fisher Electro-Hemometer. Wintrobe's hematocrit tubes were used for packed cell volume determinations; the packed cell volumes reported are accurate to within 1.0%. Red and white blood counts were made in duplicate; the duplicate erythrocyte counts had to be within 500,000 cells/cmm, the duplicate white cell counts had to be within 1000 cells/cmm. Counts which came within the stated limits were averaged and recorded. Counts which did not fall within the stated limits were repeated.

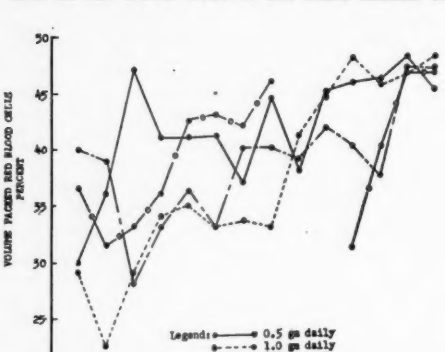

Fig. 3. Volume of packed red blood cells

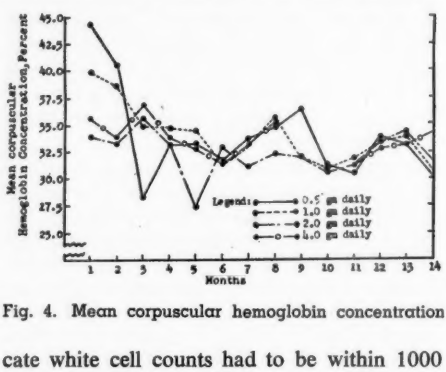

Fig. 4. Mean corpuscular hemoglobin concentration

Results and Discussion

Figures 1 to 6 show graphically the data on the erythrocyte and leucocyte counts, hemoglobin concentrations, packed volume of erythrocytes, differential counts, mean cell volumes, and mean corpuscular hemoglobin concentrations of four experimental horses on different levels of continuous low-level phenothiazine therapy.

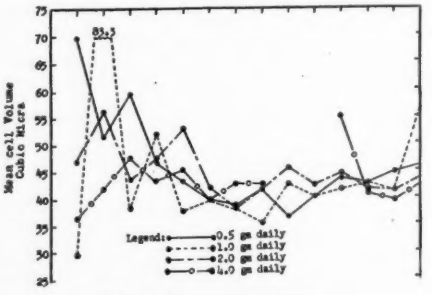

Fig. 5. Mean cell volume

There was no significant difference in the erythrocyte counts of the four horses at the end of the 14-month test period (Fig. 1). The

Thoroughbred stallion which received 0.5gm of phenothiazine daily showed a count of 9,800,000 cells/cmm; the Thoroughbred filly which received 1.0gm daily and the two grade mares which received 2.0gm and 4.0gm, respectively, showed counts ranging from 10,800,000 to 11,000,000 cells/cmm. The erythrocyte counts of the latter three mares previous to receiving continuous low-level therapy ranged from 8,600,000 to 10,400,000 cells/cmm.

A rather low red count of 4,300,000 cells/cmm prior to starting continuous low-level therapy recorded for the stallion, and a count of 2,700,000 cells/cmm recorded for the Thoroughbred filly receiving 1.0gm daily one month after the test was initiated, are regarded in complete error; the two samples had partially hemolyzed and were not repeated. At the time these pronounced drops were recorded, the general physical condition of the two animals was good.

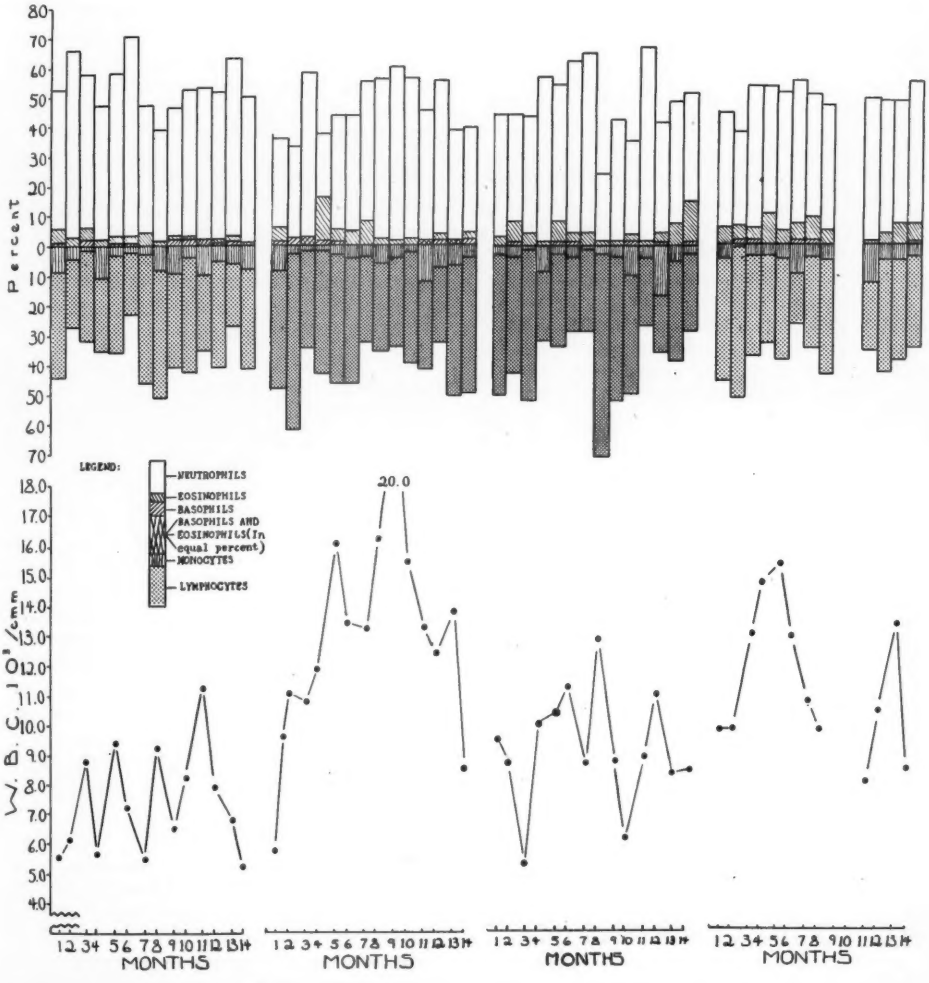

Fig. 6. The bar graphs represent the percentages of the various types of leucocytes; the polygons represent the white blood cell counts in thousands per cubic millimeter (WBC 10^3/ CMM)

The trend, in general, for the red blood cell counts of the four horses showed a decline until the fourth month of the experiment (June, 1948) with a gradual return to the pretreatment levels by the fourteenth month of the experiment. This decline and subsequent gain in erythrocyte counts is certainly correlated with change in diet beginning on July 1, 1948, and possibly with the reduction in severity of the strongyle infection in the experimental horses. A marked reduction in strongyle eggs per gram of feces in these four horses after the horses had been on continuous low-level therapy for four months was recorded, Todd *el al.,* (1949b). No blood samples were obtained from the horse receiving 4.0gm daily on the ninth and tenth month of the experiment. On the eleventh month the count was below its previous level, as were also the packed cell volume and hemoglobin record. The horse, however, was in good general condition.

The same trends were shown by the hemoglobin content of the blood of the four horses as were shown by the erythrocyte counts (Fig. 2). The hemoglobin concentrations for the four horses were higher during the last two months of the experiment than they were during the pretreatment period. The range of the hemoglobin content before the treatment began was 11.6 to 13.6 gm/100ml of blood; the range at the end of the experiment was 13.5 to 16.0 gm/100ml of blood.

Figure 3 shows a gradual increase in the packed cell volume of erythrocytes coinciding with the increase in the erythrocyte counts. In all four horses the cell volume showed an increase over the pretreatment levels with very nearly uniform values for the last two months of the experiment. The rather scattered values for the first three months may be due, in part, to the use of no standard amount of anticoagulant (citrate) which could result in marked variation in the cell volume.

Figures 4-5 show rather uniform values of the mean corpuscular hemoglobin and mean cell volume for the four horses on different levels of continuous phenothiazine therapy. The scattered values for the first three months, and in particular the high mean cell volume of the horse receiving 1.0gm daily on the second month of the test, are attributed to indiscriminate use of anticoagulant. No simultaneous increases in the mean cell volume and mean corpuscular hemoglobin were observed. Swales, *et al.,* (*ibid*), noted an increase in the mean cell volume and mean corpuscular hemoglobin in a horse following the administration of 60.0gm of phenothiazine. They suggested that this change was due to the destruction of the microcytes by the phenothiazine.

Figure 6 represents data on the leucocyte counts and differential counts. The greatest range in the leucocyte counts was observed in the horse receiving 1.0gm of phenothiazine daily. Due to the multiplicity of factors which could influence the leucocyte count, it would not be advisable to assign importance to phenothiazine as the source of changes. The horses on 0.5gm, 2.0gm, and 4.0gm daily showed relatively constant leucocyte counts and differential counts with no definite trends in any one direction. No small, darkly staining bodies referable to Howell-Jolly bodies (Swales *et al., ibid*) nor Heinz bodies were observed in the erythrocytes of the four horses.

At postmortem examination, none of the four horses showed any significant macroscopical changes. Sections of the liver, heart, lungs, kidneys and spleen were examined.

The data reported here show no apparent detrimental effects during the first year of continuous low-level phenothiazine therapy. A later report will be made on the remaining horses which will have received continuous low-level therapy for two and three years, respectively.

Summary

No significant differences were found in the erythrocyte counts of four horses fed 0.5gm, 1.0gm, 2.0gm, and 4.0gm of phenothiazine daily for 14 months. The erythrocyte counts at the end of a 14-month test were comparable to, or higher than, the pretreatment counts.

The hemoglobin concentrations of the blood of the four experimental horses were higher during the last two months of the experiment than they were during the pretreatment period.

The mean corpuscular hemoglobin concentration and the mean cell volume of the four horses remained fairly constant throughout the experiment.

At postmortem examination, none of the four horses showed significant macroscopical structural changes. Sections of the liver, heart, lungs, kidneys and spleen were examined.

Acknowledgment

The authors express their appreciation to Dr. E. R. Doll, Department of Animal Pathology, Kentucky Agricultural Experiment Station, and Dr. Peter Olafson, School of Veterinary Medicine, Cornell University, for their assistance in preparation and reading of the histological sections.

(Reference List—see page XX)

Otitis of Dogs*

By C. L. McGINNIS, D.V.M. and
R. B. ENGLAND, B.S., D.V.M.
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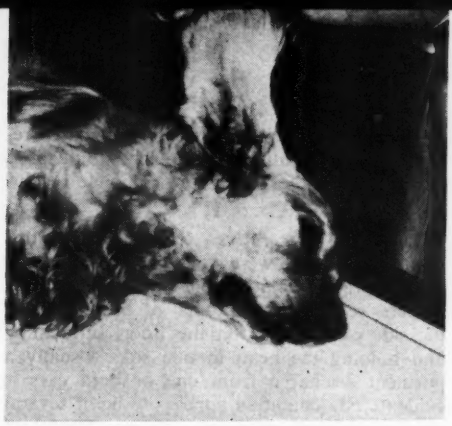
EVERY veterinarian owes some of his time every year to the support of his profession. By attendance at meetings of his state association, a practitioner gains some new information from the papers presented or new ideas from his contacts with fellow practitioners. In this way all profit as do also the clients of such professional men.

Diseases of the ears, as we encounter them in our practice, have been a serious problem for years. Extreme types in the long-eared breeds, and the manner in which such animals are kept in their owners' homes, further emphasize the necessity for treatment of abnormal conditions of the ear structures, especially those of the ear canal. In our practice, anomalies of the external auditory canal account for approximately 95% of all cases classified under diseases of the ear.

Structurally the ear canal of the dog differs from that of man principally in its length and direction. A long speculum is necessary for the examination of the depth of the canal in the dog and the tympanum is not easily seen. The surface of the normal ear canal is pale, slightly oily, clean and with a varied amount of earwax. In the flop-eared breeds, of which the modern Cocker Spaniel is an outstanding example, the ear flap partially closes the canal opening, adding to difficulties by forming a closed and blind cavity in which conditions frequently are favorable for the multiplication of parasites and the growth of molds and bacteria irritating to the canal lining. Further detritus, resulting from cellular irritation accumulate, instead of draining away results in exacerbation of the mucosa.

One of us, (R.B.E.), made a survey of 150 routine ear cases presented at our hospital. This study was made to determine etiology, pathology, treatment, duration of treatment and final disposal. All were classified into eight groups and are discussed in accordance with their numerical importance as follows: (1) Parasitic otitis, (2) acute ulcerative otorrhea, (3) chronic otorrhea, (4) catarrhal otitis, (5) acute inflammatory otitis, (6) traumatic otitis, (7) allergic otitis, and (8) foreign body otitis.



Postoperative appearance after complete resection to open the external ear canal.

1. *Parasitic Otitis.*—Of the 150 cases, 74, approximately 50%, were due to infestation by the ear mite, *Otodectes canis.* The largest number of dogs in this group were younger than one year of age, but animals of all ages were included. We were amazed by this large number found by the mere expedient of looking for the mites. As our study progressed it became increasingly evident that many chronic ear conditions are due to original, untreated ear mite infestation. Symptoms begin with evidence of mild irritation, with scratching at the affected ear or ears and shaking the head. The scratching advances in severity as the mite population increases and the length of time the condition is allowed to persist, with the resulting trauma to structures surrounding the ear, and the appearance of dried cerumen at the orifice. In advanced cases, quantities of this material pack the ear canal causing severe irritation and inflammation, with a subsequent change of character that may lead to a number of various types of ear anomalies as now classified. A small amount of the cerumen obtained from the ear, by gentle swabbing with a cotton swab, and a few flakes transferred to a drop of mineral oil on a slide, will reveal the mite under the low power of the microscope. Frequently, the mite may be seen with the naked eye crawling upon the swab.

For treatment of parasitic otitis, we routinely use undiluted canex (Merck). Enough of this oily preparation is used so that some of the material spills out over the margins of the opening and immediately below. Irritation caused by the mites apparently stops immediately since scratching ceases. The treatment is responsible for slight inflammation of the canal lining, which is noticed to be moist after 24 hours. Gentle swabbing and alternate use of sulfathiazole powder and a healing ointment, as indicated, for three days generally suffice

*Presented at the 59th annual meeting of the Missouri Veterinary Medical Association, St. Louis, June 6-7, 1949.

to effect complete recovery. We regularly request that the patient be returned for examination in two weeks to assure complete resolution.

2. *Acute Ulcerative Otorrhea.*—In this group 27 (18%) were dogs on which no history of previous ear trouble was obtained. The owners reported symptoms of first rubbing the side of the head on the floor, scratching, and holding the head to one side. Usually a purulent discharge from one or both ears is evident. The condition appears to be of several days to a week or more duration. Speculum examination prior to cleansing reveals the external canal more or less filled with a dark pyogenous exudate. When cleaned by swabbing or washed away with warm water (we do not use soap, although a mild liquid soap may assist in cleansing) typical ulcers are noted at one or more locations on the lobulations deep in the external canal. These bleed easily and are very sensitive.

Gentleness in cleaning must be emphasized. It is important to avoid further traumatizing ulcerated areas. Treatment by cleansing and daily application of sulfathiazole powder for four or five days, the use of a bland ointment, when indicated, to soften encrusted material, and repeating the powder packs, effects recovery in our experience within seven to 14 days. Surgery is seldom indicated in this type of otorrhea.

3. *Chronic Otorrhea,* (23 cases, 15.3%).—This type includes those cases that have been "through the mill." They were neglected early in the attack and home treatment proved disappointing. When finally presented to us for treatment a copious purulent discharge is noted. The underlying tissue is reddened, eroded or showing proliferative growth over a portion or all of the ear canal. The tympanum may be ruptured, exuberant tissue granulations and a bloody odorous exudate may partly occlude the canal. A guarded prognosis is always given. Surgery is advised for adequate drainage. We employ the technic of Formston and McCunn as modified by Lacroix to provide, by cartilage resection, drainage of the external ear canal. The prospects of success of this operative procedure are considered good and patients are relieved of discomfort after a week to 10 days. If infection of the middle ear is concurrent, discharge persists and recovery may be delayed for weeks; eventual relief of all symptoms being the outcome.

4. *Catarrhal Otitis.*—Eighteen cases (13%) were placed in this class. Dogs suffering a catarrhal otitis do not show symptoms of severe distress. Their owners are, ordinarily, concerned because of the sour odor emanating from the ears. Scratching in the region of the ears and shaking the head are regular symptoms but the lining of the ear canal is not especially sensitive. Cerumen is sticky, grey and wax-like in nature adhering to the walls of the canal which has not undergone change in color. There are no ulcers or pustular exudates. We treat this type of otitis by cleansing with ether swabs and applying sulfathiazole powder alternated with a mild ointment. Recovery is effected within a few days. Penicillin ointment of the type used for intramammary injection has served us well in many of these.

5. *Acute Inflammatory Otitis.* (Four Cases).—Symptoms of this type of otitis are sudden onset and severe pain. The external auditory canal is reddened and swollen. No exudates or excessive débris is present. Our treatment includes the application of sulfathiazole powder which relieves the pain within three to five hours. Subsequent treatment includes cleansing with ether and application of sulfathiazole powder daily for three days. In our experience, recovery is effected promptly.

6. *Traumatic Otitis,* (Two Cases).—Fight wounds and other injuries, involving the external ear canal, respond promptly with cleansing and ordinary wound application.

7. *Allergic Otitis,* (One Case).—This animal showed severe symptoms of urticaria. It involved the ear canals and responded nicely to oral pyribenzamine therapy.

8. *Foreign Body Otitis,* (One Case).—Awns of foxtail and other grasses, when lodged in the ear canal, set up irritating disturbances that respond when the cause is removed. General anesthesia is frequently necessary to remove these sharp-pointed seeds. A small alligator forceps has served us well in removing such material.

Summary

Since the incidence of parasitic infestation in the group of 150 cases reported reflect so high a percentage of otitis presented for treatment, the need for careful examination for ear mites in all such cases is emphasized. It is the opinion of the authors that even in those advanced cases where purulent exudates are apparent that pathological changes may have originated from previous mite infestation.

Demyelinating Diseases of Animals*

Part II. The Relation of Distemper Infection to the Etiology of Canine Encephalopathies

By J. R. M. INNES,** Sc.D. (Cambridge), D.Sc. (Edin.), Ph.D., M.R.C.V.S., F.R.S.E
Microbiological Institute, National Institutes of Health, Bethesda, Md.

(Continued from the October issue of VETERINARY MEDICINE, *Page 421)*

Experimental Pathological Contributions Until 1948

Posrednik[36] described demyelination in natural cases of distemper encephalitis and produced similar lesions experimentally, but there is no indication of the source of his infective material. We certainly cannot be certain he was working with distemper. The same comment can apply to the work of Kantorowicz[24], Puntoni[37] and Robin and Vechiu[39]. The work of de Monbreun[4] is also open to suspicion and deserves special comment. The second part of his paper deals with experimental distemper encephalitis and is full of excellent pathological description. The material from which subsequent inoculations were made was, however, obtained from a dog which died after an acute illness of 30 hours and this same hyperacute lethal disease was reproduced in experimental dogs. In neither pure distemper virus infections, nor in natural cases of distemper in dogs (if that can be diagnosed) is such an acute clinical syndrome seen. Further, the ferrets reacted differently to infection as they did not develop coryza until the 25th day, an incubation period outside that generally accepted for distemper. The encephalitis produced in dogs also seemed to be of an acute hemorrhagic variety. Finally, the author describes and illustrates inclusion bodies in hepatic cells which are identical with those stated by Green[19] to be due to fox encephalitis virus in dogs (which were also seen personally). There thus seemed some justification for Green's contention that de Monbreun had worked in fact, not with distemper, but with the fox virus. This is a noteworthy comment because de Monbreun's work has been largely quoted in connection with distemper pathology in general. This complexity is not made simpler by more recent important observations of Rubarth[40]. This author has written an extended work, of a standard rarely seen in veterinary pathology, of the results of an assiduous study of 12 years in Sweden. He describes a condition named hepatitis contagiosa canis based upon 190 autopsies and extensive experimental work. It occurred mainly in young dogs (although up to four and five years was not rare) which showed a febrile illness of short duration and some symptoms quite like distemper. The lesions were a dominant liver pathology with necrosis, fibrinous perihepatitis, and edema of the gall bladder, etc. Although some dogs showed paresthesia, blindness, convulsions, cerebral lesions were not prominent but he mentions the presence of glial clusters and perivascular hemorrhages. It was proved to be an infectious and contagious disease, caused by a filterable virus from which many dogs survived. Dogs immune to this infection could be infected fatally with distemper. The interest of this work, as far as we are concerned, lies in the description of the universal presence of intranuclear inclusions in hepatic cells identical with those described by Green in fox encephalitis infection in dogs and by de Monbreun in his experimental dogs. Rubarth suggests that Green was in fact working with this virus of hepatitis contagiosa canis. This disease has not been recognized so far in England††, but it has been described in the States by Coffin[8] and Riser[38] while Bloom (private communications) has informed me that he recognized the condition ten years ago, now diagnoses it clinically and I have been privileged to see some of his pathological material. Kriesel[27] also came to the conclusion that de Monbreun might have been working with the fox encephalitis

*Reprinted from *Vet. Rec.* 61:73 (1949), by permission of the editor.

**Doctor Innes is a special Research Fellow, U. S. Public Health Service, Division of Mental Science, Microbiological Institute, National Institutes of Health.

††No disease is of course recognized until it is found by looking with great care and in many cases we must admit that autopsy work and selection of tissues for histological examination is done with much bias. We take refuge in saying that one cannot do everything. I have, however, seen cases of liver necrosis in dogs with a clinical history such as Rubarth describes but I never looked for inclusion bodies in the liver. (Since writing the above a re-examination of slides and data from canine autopsies made many years ago has revealed three cases of contagious hepatitis in dogs in many ways identical with Rubarth's findings—the first case occurring in 1935[18].)

virus and not with distemper. In his experimental dogs there was much dissimilarity in the course of the two infections. He noted the presence of the inclusions described by Green in 100% of the dogs infected with fox virus but they also were seen in 18% of the distemper virus infections in dogs. Cordy[8] carried out some experimental work with dogs using a commercial strain of distemper virus. In one group he failed to produce lesions in the nervous system. It has been mentioned also that he failed to transmit old dog encephalitis (which bears a similarity to my lymphocytic perivascular encephalitis with diffuse sclerosis) to ferrets.

The other contribution of merit is that of Hurst, Cooke and Melvin[16]. The work of Hurst on the encephalitides, neurotropic viruses and the demyelination problem is known to all workers in these fields. The paper contains an unrivaled account of pathological detail of demyelinating encephalopathy in dogs in Australia. It was concluded that many of the lesions bore a close resemblance to those in the more severe demyelinating diseases of man. Bearing in mind what has been said about clinical and pathological diagnosis, the same uncertainty might arise as to whether these demyelinating lesions were in fact due to the distemper virus. Hurst *et al.*, reproduced in experimental dogs demyelinating lesions identical with those seen in natural cases with ease. The inoculating material was, however, obtained from natural cases and they admit that some of the immunity tests were performed before the initial infection had run its course. They then fully discuss the question whether they were dealing with two viruses closely related, if not antigenic duplicates. While this part of the work might be suspect, they also produced the same lesion in dogs by intracerebral inoculation of authenticated distemper virus obtained from the Commonwealth Serum Laboratories. Their claims therefore must be seriously considered with, but tempered by, the more recent work of MacIntyre, Trevan and Montgomerie[20].

In conclusion, to this section, it can be said safely that the claims based on experimental grounds regarding the role of the distemper virus in any variety of encephalitis, least of all a demyelinating form, rested on rather tenuous and controversial evidence. Most of the contributors (except in some of Hurst's work) had derived their infecting inoculum from natural street infections and we know the difficulty attending absolute diagnosis of such cases. My own limited experimental work demonstrated further, that until pathological examination of many dogs was completed we did not really know what we were trying to transmit from one case to the next. It was, however, clear that distemper virus could not be recovered easily from the brain from any type of encephalitis, and by us never at all. A demyelinating encephalopathy certainly has occurred in dogs for years and it seems as if this was due to some virus which might indeed produce an initial fever like distemper. It remained to be proved whether this virus was that of distemper as described by Dunkin and Laidlaw and which for generations has been said to be the major febrile scourge of dogs.

Neurotropic Viruses and Canine Encephalitis According to MacIntyre, Trevan and Montgomerie

This work was first communicated to the National Veterinary Congress in August, 1948. The authors describe five separate neuropathological entities in dogs. Their main conclusions are briefly enumerated, from which it is clear that considerable advances have been made, many previous results can be better understood and some puzzling features of canine nervous disease explained.

1. *Distemper in dogs* (Their Group Ia): Many cases of so-called encephalitis were associated with the invasion of the brain by the true distemper virus, yet the strains isolated from such cases showed no real neurotropic properties. They also observed that even when dogs were inoculated by the intracerebral route, typical distemper was produced and perhaps without any signs of nerve cell damage. Of the many thousands of susceptible dogs injected during the production of distemper virus vaccine, less than 20 showed signs of nervous disease. In the brains of animals in this group which showed some signs of nervous involvement, neuronal damage and small hemorrhages were found but no inflammatory reaction or demyelination. Ferrets inoculated with material from these cases behaved in the classical way and strains of the virus were readily neutralized by distemper anti-serum.

2. *"Hard pad disease"—with demyelinating encephalopathy* (Their Group Ib): This disease affected dogs of all ages which showed catarrhal symptoms, usually irregular and intermittent fever although sometimes a subnormal temperature persisted throughout the illness. Severe diarrhea was common. There might be some pneumonia but an outstanding lesion was a hyperkeratosis of the footpads appearing within one week of illness. At the same time nervous symptoms might develop—convulsions, screaming fits, blindness and para-

plegia. The autopsy might reveal enteritis, cystitis, hemorrhage and edema of the lungs and no macroscopic changes in the brain. Histologically, the important lesions were the demyelinated foci in small scattered areas in cerebellar peduncles and folia, glial proliferation, swelling and proliferation of vascular endothelium, and intranuclear inclusion bodies in glia, histiocytes and ependyma. The injection into ferrets of emulsions made from footpads, spleen, brain or lung set up a disease like distemper but with an incubation rarely less than 17 days but often as long as 32 days and unlike distemper in ferrets, recovery was not uncommon. Attempts to transmit the disease to dogs produced only a febrile reaction lasting 14 days.

3. *Demyelinating encephalitis* (Their Group II): This form of disease was said to occur in dogs of all ages which showed mild catarrhal affections, dry cough with, perhaps, later development of nervous symptoms (convulsions, paralysis, chorea or ataxia) the animals dying in a coma. There were no lesions in the pads and the encephalitic lesions seemed to be like Group Ib. One prominent distinguishing feature of this condition from hard pad was the complete inability to infect ferrets with Seitz-filtered material but in several attempts one dog injected intracerebrally became affected.

4. (Their Group III): Dogs in this group were said to develop an insiduous nervous disorder without signs of generalized infection. The cerebral lesions consisted of perivascular lymphocytic cuffing of vessels but no demyelination or neuronal damage. All attempts to transmit infection to ferrets or dogs failed.

Other types of encephalitis are briefly mentioned, associated with toxoplasma (Group IV) and nutritional conditions (Group V) but they do not concern us here. It would seem, however, that at least some clarification has been reached regarding encephalitis in dogs and that we might discard the idea that the distemper virus under natural conditions, or experimentally, can produce an inflammatory or demyelinating form of encephalitis. The difficulties of working with dogs to exclude distemper are clearly brought home. The previous confusion which arose on clinical grounds is apparent but some light may ultimately be shed on pathological entities, checked and rechecked with adequate experimentation. Out of chaos, therefore, we see some semblance of order. When more detailed pathological descriptions are available from this notable work of MacIntyre, Trevan and Montgomerie, it may be possible to correlate some of the previous data of others. At the moment, the type of encephalitis seen in either their Groups Ib or II might coincide with the well-recognized, oft-described, demyelinating lesion of other workers. On the other hand, Group Ib might be a new entity because of the peculiar hyperkeratosis of pads, while their Group II might represent what has so often before been called post-distemper encephalitis, my disseminated encephalitis and Scherer's acute multiple sclerosis of dogs. (I have never at any time observed

Many problems associated with nervous disorders in dogs remain to be solved.

the pad lesions but this may not be surprising. I have mentioned in a footnote how blind pathologists can be and how lesions can be missed easily unless one is actually looking for them. The history of veterinary pathology is strewn with examples of this nature for if more attention had been paid in the past to more rigorous examination for pathological detail many diseases would have been identified years before they actually were. That has been the result of an inordinate ardor for microbe hunting.) The lymphocytic encephalitis (their Group III) might correspond with my cases of diffuse sclerosis, with Cordy's old dog encephalitis and with the one case of Scherer and Collet. It would seem that this type is quite specific and if all are the same then it would appear to be nontransmissible to ferrets or other dogs.

Many problems associated with nervous disorders in dogs remain to be solved but many apparent complexities of the past have at least been partly clarified by the work of the Wellcome team. A virus has been shown to be

associated with a demyelinating lesion, which by itself is most important, because the demyelinating diseases of man form probably the biggest problem confronting medical neurologists of today. Experimental studies along the lines so admirably started may have many repercussions besides the immediate practical one of solving the causation of diseases of dogs, which is of importance to the veterinarian. For a long time it has been considered that viruses were not involved in the etiology of any of the demyelinating encephalitides but this view must obviously be reconsidered. An immediate need would be the successful transmission of the disease from dog to dog but positive results by the use of brain emulsion should of necessity be tempered by the results of Kabat *et al.*, who have produced severe neurological manifestations and demyelination by the injection of heterologous and homologous brain emulsions in monkeys.

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*These references are for the article by the same author which appeared in the October issue of VETERINARY MEDICINE, page 421, and for this article.

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Lead Oxide Poisoning in Mink

Red lead in oil is often applied to metal surfaces, wire of pens, feed and water pans, on mink ranches. This antirust treatment of metal is a common cause of poisoning in mink. Drinking acid water, which has passed through lead pipes is another source which could conceivably induce lead poisoning. Research at the Fur Animal Division, Research Laboratory, Washington State College, has shown that a small amount of red lead paint on a wire bottom pen can cause the death of young or adult mink, confined in such pens.

Symptoms shown by experimental cases were loss of appetite, incoördination, stiffness of gait, trembling, dehydration and mucopurulent conjunctivitis.

Treatment includes removal of animals from painted pens and provision of adequate amounts of dicalcium phosphate or calcium gluconate powder and vitamin D concentrates in the form of fresh fish oil in the feed.

Benzene Hexachloride Dips for the Destruction of Psoroptic Scabies Mites on Shorn Sheep*

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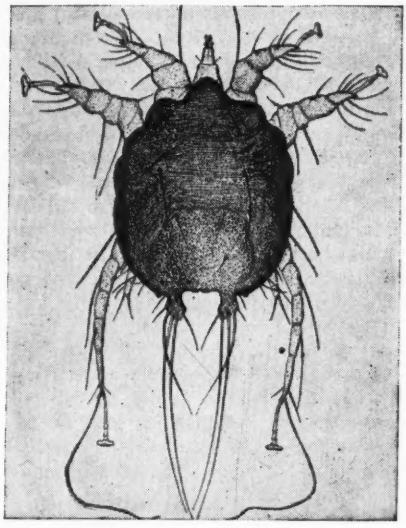
IN DETERMINING the effectiveness of benezene hexachloride (BHC) against psoroptic or common scabies of sheep (*Psoroptes equi*, var. *ovis*), it was found by Kemper[1], and Kemper and Roberts[2] that this parasiticide is highly effective for the destruction of mites on unshorn sheep. Fleeces of unshorn sheep retain large quantities of fluid after dipping and dry slowly. It is logical to assume, therefore, that retention of the insecticide by the long wool contributes to the destruction of mange mites. Any scabies control program, however, involves the treatment of far more shorn than unshorn sheep, because it is desirable to dip sheep during the summer and early fall months when the weather is warm. For this reason, it became necessary to determine if benzene hexachloride dips are effective against scabies mites on sheep that have been clipped recently.

The scope of the work described in this paper involves the use of BHC as a dip for the control of psoroptic mites on recently shorn sheep. In addition, the work includes limited tests designed to show: (1) the minimum effective gamma isomer concentration required to destroy the mites on recently shorn sheep, and (2) the rapidity with which mites on shorn sheep are destroyed by various concentrations of gamma isomer.

Materials and Methods

The tests were conducted on farms in the Blue Ridge and Alleghany Mountains on both sides of the Virginia-West Virginia state line, during June and July 1948. There is considerable diversification of agriculture in this region, and sheep raising is practiced only on a limited scale. The flocks in this area are all small, generally containing fewer than 200 ewes, and are grazed in well-fenced, hillside pastures. The sheep are of the medium wool type; ewes are chiefly Dorset-Cheviot-Hampshire-Suffolk grades, and most of the rams are purebred of one or another of these breeds. The quality and condition of the animals at the time of these tests were excellent. During July some of the lambs, dropped on or about April 1, weighed as much as 100 pounds. All mature animals had been shorn on or about June 1. During June, the wool of the ewes averaged approximately ¼-inch in length, whereas that of the unshorn lambs was from ⅜ to ¾-inch in length, depending upon the size and age. Clinical psoroptic mange existed on a few isolated farms in this region, but it was only after a protracted search that five flocks, on as many widely scattered farms, were selected for test. In each flock, live mites and some evidence of clinical mange were found on one or more animals.



Psoroptes equi var. *ovis* (male, dorsal view greatly enlarged) the common scabies mite of sheep.—After Solmon and Styles.

The BHC used was a commercial, finely ground, wettable product consisting of 50% of technical grade (all isomers) benzene hexachloride, and 50% of inert dusts and wetting agents. The gamma isomer content of the mixture was 6%. Dips were prepared by the addition of the wettable powder to cold spring, stream, or well water. Temperatures of the dips varied from 65° to 78° F. The sheep were dipped in the usual manner and all animals, including lambs, were held in the dip for two

*From the Zoological Division, Bureau of Animal Industry, Agricultual Research Administration, U. S. Department of Agriculture.

minutes or a few seconds longer. All heads were submerged momentarily two or more times to assure thorough wetting of the entire body surface. The sheep received only a single treatment.

The object of experiment number 1 was to determine the effectiveness of suspension of BHC containing 0.03 and 0.015% gamma isomer against psoroptic mites on shorn sheep. Five small flocks of recently shorn animals were dipped under ordinary farm conditions. A portable, 175-gallon capacity steel vat of standard design, equipped with ramps and draining pen, was used to dip the three larger flocks (tests one, two, and three). The two smaller flocks (tests four and five) were dipped in 55-gallon steel drums. The most heavily infested animals in each group were paint-branded, shear-marked, or otherwise identified for future examination. At post-treatment examinations, the sites of former scab lesions were examined carefully with the aid of a hand lens for the presence of viable mites. Skin scrapings and wool samples were removed and examined microscopically, for the presence of live or dead mites, as soon after collection as possible. A study of the condition of the skin and the rate of resolution of injured tissue was also made.

Experiment number two involved only three recently shorn ewes and three young lambs, all members of the same flock. The six animals were chosen because of the existence of clinical scabies, and ewes and lambs were not related. Although lesions were more advanced on the ewes than on the lambs, a far greater number of live mites were found on the lambs. Three tests were conducted with the dual purpose of demonstrating the minimum effective gamma isomer concentration required to destroy mites on recently shorn sheep and the rapidity with which mites are destroyed by various concentrations of gamma isomer. In each test, a ewe and a lamb were used. The pair used in the first test was dipped in a suspension of BHC containing 0.0075% gamma isomer; the pair in the second test, in a suspension containing 0.015% gamma isomer; and the pair in the third test, in a suspension containing 0.03% gamma isomer. A 55-gallon steel drum served as a dipping vat. After treatment, the animals were confined in small pens and were examined at frequent, irregular intervals during a 44-hour period. At each examination, mites were located on the skin or in the wool of each animal with the aid of a 10X lens, picked up with a scalpel, and placed in droplets of lukewarm water on microslides. The mites were examined immediately under a low-power microscope for evidence of viability.

Experimental Data

Experiment No. 1. Test No. 1. This group of animals consisted of 65 ewes and lambs. Advanced scab lesions were found on almost all ewes and on several lambs. Many mites were seen on several adult animals showing lesions, and even larger numbers of mites were found on the unshorn lambs. Five ewes and four lambs, all showing symptoms of clinical mange, were identified with branding paint for future examination. The flock was dipped in a suspension of BHC containing 0.03% gamma isomer. The marked animals were examined for the presence of mites eight days after treatment, at which time dead mites, but no live mites, were recovered from the skin scrapings. A second examination was made 34 days after treatment; neither live nor dead mites were found.

Test No. 2. This farm flock totaled 93 ewes and lambs. Advanced scab lesions were observed on approximately 12 ewes; on several of these animals small numbers of live mites were found. Four of the more heavily infested ewes were identified for future examination. The flock was dipped, as in test no. 1, in an aqueous suspension of BHC; the gamma isomer content of the dip was 0.03%. The entire flock, and in particular the four most heavily infested ewes, were examined for symptoms of scab and for the presence of mites 28 days after dipping, neither live nor dead mites being recovered.

Test No. 3. The flock used in this test consisted of 32 ewes and lambs. Advanced scab lesions were seen on most of the ewes and several of the lambs. Live mites were found on four ewes and three lambs, and these animals were identified for future examination. The flock was dipped in a BHC suspension containing 0.03% gamma isomer, as in tests nos. 1 and 2. Twenty-one days after treatment, the previously identified ewes and lambs were minutely examined for the presence of mites. Microscopic examination of skin scrapings revealed neither live nor dead mites.

Test No. 4. A flock consisting of only four ewes and five lambs was used in this test. Advanced scab lesions and live mites were found on only one of the ewes, but the remaining eight animals had been exposed to the infested ewe for a minimum of two months. The flock was dipped in a suspension of BHC containing 0.015% gamma isomer. Twenty-four hours later, the previously infested ewe was examined. No live mites were found, but the skin scrapings were not examined for the presence

of dead mites. Thirty-two days after treatment, the entire flock, particularly the one previously infested ewe, was examined for evidence of scabies and the presence of mites. Neither live nor dead mites were recovered.

Test No. 5. Nine ewes and four lambs, isolated from the remainder of a larger flock, were selected for this test. Advanced scab lesions were found on three ewes, but live mites were seen on only one of these and on a lamb showing incipient lesions. The animals were all dipped, as in test no. 4, in a suspension of BHC containing 0.015% gamma isomer. Thirty-two days later, the three ewes showing lesions, including the one on which live mites had been found, and the previously infested lamb, were examined. Neither live nor dead mites were recovered.

Ewe showing advanced lesions of psoroptic mange with loss of wool and presence of scab.

Benzene hexachloride suspensions containing 0.015 and 0.03% gamma isomer proved completely successful in destroying all mites on five small flocks of infested, recently shorn sheep. Following the destruction of mites, healing of all former scabies lesions progressed rapidly. Incipient lesions on previously heavily infested lambs showed evidence of healing within two days, and serum at the peripheries of even the largest of such wounds had dried hard. Small, acute lesions were completely healed three weeks after treatment, and occasionally were no longer visible one month following dipping. Heavy encrustations over the chronic lesions had separated from the skin three weeks after the destruction of the mites, and the skin beneath was soft, pliable, and frequently oily. The resolution of lesions progressed more or less rapidly in all flocks.

Experiment No. 2. Test No. 1. The test animals consisted of a shorn ewe and a lamb two months of age. A few mites were found on the ventral body surfaces of the ewe, but many mites could be seen widely distributed on the lamb. The animals were dipped in a BHC suspension containing 0.0075% gamma isomer. Mites were removed from the sheep and examined microscopically three, four, 30, and 44 hours after dipping. Of the total number of mites removed from both animals, between three and four hours after application of the BHC, 25% showed occasional leg movement. Thirty hours after dipping neither live nor dead mites could be found on the ewe, whereas 20% of the mites removed from the lamb showed sporadic, exceedingly feeble movement of the pedicles, and rarely of an entire leg. At 44 hours after treatment, no live mites could be found on either the ewe or the lamb. Examination of skin scrapings and wool samples revealed several dead, desiccated mites.

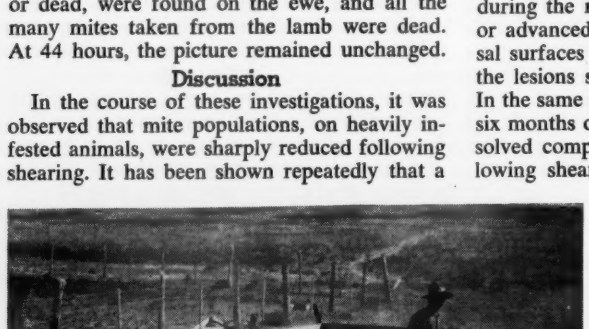
Test No. 2. The test animals consisted of a shorn ewe and a three-month-old lamb. A few mites were found on the head and in the inguinal pouches of the ewe, and many mites were seen on the dorsum of the lamb, in association with advanced lesions. The sheep were dipped in a BHC suspension containing 0.015% gamma isomer. Mites were removed from the animals and examined microscopically one, two, and 44 hours after treatment. Of the total number of mites removed from both animals one hour following dipping, 50% showed some leg movement. At two hours after dipping, all mites were dead. At 44 hours after treatment, skin scrapings and wool samples from the ewe were negative for live or dead mites; those from the lamb revealed dead mites only.

Test No. 3. One shorn ewe and a two-month-old lamb were used in this test. The ewe had a huge area of advanced and chronic lesions but only a few live mites were found, some of which were in the ears. The lamb was

heavily infested with live mites. The animals were dipped in a suspension of BHC containing 0.03% gamma isomer. Mites were removed from the sheep and examined microscopically one, two, and 44 hours after dipping. At one hour after treatment, 33% of the total number of mites removed from the ewe and lamb showed sporadic, feeble leg movement. Two hours after dipping, no mites, alive or dead, were found on the ewe, and all the many mites taken from the lamb were dead. At 44 hours, the picture remained unchanged.

Discussion

In the course of these investigations, it was observed that mite populations, on heavily infested animals, were sharply reduced following shearing. It has been shown repeatedly that a great many mites are removed with the fleece during the shearing process. In addition, after shearing there is a further reduction due directly or indirectly to sunlight and intense heat. Psoroptic mange mites are either destroyed by direct sunlight or are perhaps driven to the ends of the wool fibers by the high temperatures of the skin surface, and from this precarious position they probably drop to the ground, where they die. In any event, as early as 15 days after shearing, it was exceedingly difficult to find live mites on the dorsal and lateral surfaces of previously heavily infested ewes. The few remaining mites were found, for the most part, on the ventral body surfaces. Live mites were most frequently found in the inguinal pouches, in a strip anterior and posterior to the umbilicus, and occasionally on the vulva and in the submaxillary region. Although a few mites survived throughout the summer on the shorn ewes, it is apparent that they were responsible for no new lesions until the advent of cool weather and until the wool growth was an inch or more in length. Lambs, however, which showed incipient or advanced lesions by June 1, apparently served as hosts to somewhat larger numbers of mites throughout the hot summer months. The mites on the lambs were also more widely distributed than on the ewes. The longer wool on the lambs doubtless accounted for this situation. In conjunction with the virtual disappearance of mites from the ewes, it was noted during the month of June that when incipient or advanced, acute mange lesions on the dorsal surfaces had been shorn of wool covering, the lesions showed an early tendency to heal. In the same manner, chronic lesions, indicating six months or longer of mite activity, often resolved completely during the two months following shearing. Lesions on the lambs, however, seldom healed spontaneously during the summer, but were more often quiescent than active.



Improvised dipping equipment suffices for small farm flocks. Either a 55-gallon steel drum or watering trough serve well.

Benzene hexachloride has been shown effective in eradication of psoroptic mite infestations on shorn or unshorn sheep following a single dipping. It is not known to what extent BHC, in the concentrations used, is ovicidal, nor how important is its role as a residual toxicant to the larval mites hatching from viable eggs remaining on the skin after treatment. Very likely both of these actions are exhibited. If residual activity, however, is of importance in the control of mange, then theoretically BHC suspensions should prove more effective as an acaricide on unshorn than on shorn sheep. It can be reasoned that the long fleeces retain comparatively large quantities of the parasiticide, and provide positive and sustained contact between the acaricide and the larval mites which hatch from viable eggs during the seven-day incubation period following dipping. It is quite apparent, however, that when BHC is used as an acaricide,

the length of fleece at the time of dipping has little or no bearing on scabies control. This acaricide has been shown to destroy all larval and adult mites within two hours after dipping, and its combined ovicidal and residual action is obviously equal to the task of completing eradication in spite of the smaller quantities of dip retained on shorn sheep.

The tests described in this paper appear to indicate that relatively minute concentrations of the gamma isomer of BHC are sufficient for the control and eradication of psoroptic scab of sheep. It has been shown that gamma isomer concentrations as dilute as 0.0075% succeeded in destroying all adult mites on dipped, shorn animals in pen experiments. Tests on farm flocks suggest that as little as 0.015% gamma isomer eradicated scabies from shorn animals. However, the author wishes to emphasize the recommendation that dips containing no less than 0.06% gamma isomer be used in scabies control practices on farms and ranches. As discussed at length by Kemper and Roberts[2], a long list of factors may contribute to possible failure, under ordinary field conditions, of the minimum lethal concentration of an acaricide. These include; (1) the frequent errors in estimating the contents of vats; (2) the tendency of particulate matter in suspension to settle irretrievably into the mud and dirt at the vat bottom; (3) the probable filtering action or exertion of surface energy by fleeces, with the consequent loss of suspensoids early in the dipping operation; and (4) the dilution by rain of already diluted acaricidal materials in the fleeces. A concentration of 0.06% gamma isomer is known to be considerably higher than that required under ideal circumstances, and should provide ample compensation for whatever allowances must be made on the farm.

The tests herein outlined were terminated following a post-treatment observation period of approximately one month. From the standpoint of strictest accuracy, this procedure is not recommended, particularly during the summer months. Following the destruction of adult mites, but in the presence of a small number of viable ova, it is not unusual for occult infestations to remain undetected, even to the practiced eye, for many months after treatment. This is especially true during the warm months of the year, when, as already stated, psoroptic mites are ordinarily dormant. Considerable experience has shown that a definite diagnosis of scabies should be deferred for approximately 90 days following treatment, and longer if possible. During this period, minute, unrecognizable incipient lesions are permitted sufficient time to enlarge to the point of visibility on the relatively huge body surface of a sheep. In the summer, moreover, lesions progress so extremely slow that it is wise to await the advent of cold weather before pronouncing experimental animals free of mites. The sheep involved in these tests were painstakingly examined for evidence of live mites, and skin scrapings were examined microscopically for the presence of visible larvae. At the end of 30 days, no indication of existing scabies was apparent, and neither viable ova, larvae, nor adults could be found on the experimental animals. Nevertheless, the results of these tests would have been somewhat more reassuring if circumstances had permitted the isolation of these animals for several months instead of only one, prior to final examination.

Summary and Conclusions

1. Light, moderate, and heavy infestations of the common sheep scabies mite, *Psoroptes equi*, var. *ovis*, were eradicated from shorn sheep following a single application of BHC. A total of 190 sheep in three farm flocks were dipped in BHC suspensions containing 0.03% of gamma isomer. No live mites were found on any of the animals during a period of from three weeks to one month following treatment.

2. Very light infestations of scabies mites were eradicated from 22 shorn sheep in two flocks following single applications of BHC suspensions containing only 0.015% gamma isomer. No live mites were found on any of the sheep during a period of one month after treatment.

3. In a series of pen experiments, a dip containing 0.0075% gamma isomer destroyed all adult mites on shorn sheep in less than 44 hours; a dip containing 0.015% gamma isomer destroyed all adult mites in less than two hours; a dip containing 0.03% gamma isomer destroyed all adult mites in less than two hours.

4. Despite the fact that lower concentrations of gamma isomer of BHC are effective under controlled conditions, dips containing not less than 0.06% gamma isomer are recommended in connection with psoroptic scabies eradication programs on farms and ranches.

References

1. Kemper, H. E., Progress Report on Benzene Hexachloride for the Destruction of Sheep Scab Mites. *Vet. Med.*, 43:77-79 (Feb.), 1948.

2. Kemper, H. E. and Roberts, I. H., Benzene Hexachloride Dip to Destroy Scab Mites on Unshorn Sheep. *Vet. Med.*, 44:163-169 (Apr.), 1949.

Veterinary Problems in Poultry Production

By W. R. HINSHAW, D.V.M., Ph.D., Frederick, Maryland

Turkeys are susceptible to the virus of avian pneumoencephalitis and the manifestations of the disease in turkeys are the same as in chickens. In strictly turkey producing areas, the disease has not yet become as great an economic factor as it has for the chicken producer, nor have acute outbreaks with heavy losses been so often reported. These facts should not make the turkey grower over-confident that he will not experience losses from the disease. Whether or not to vaccinate turkey flocks is a question that needs consideration for each community. In areas where the disease is prevalent, vaccination is probably advisable, but careful consideration should be given to the matter before advising a client to vaccinate if the disease has not yet become a problem in his community.

In a recent paper on the disease in turkeys, Pomeroy (*Turkey World* 24:25 (May), 1949), states that there are two good reasons for the turkey breeder producer to vaccinate: (1) poults hatched from immune hens will have a passive immunity for two to four weeks and (2) protecting the flock will prevent a possible drastic egg loss if the flock becomes exposed during the laying season.

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"Balut" is the subject of a paper in the September issue of *The U. S. Egg and Poultry Magazine*. In case you do not know what the author means, balut is an egg dish prepared by hard-boiling duck eggs which have been incubated for 18 days. These eggs are eaten out of the shell with the fingers and are, according to the author, one of the food delicacies of one Filipino tribe known as the Tagalagogs, residing in the area near Manila, and also of the Chinese. The rearing of ducks is one of the major industries of the Philippines, largely as the result of the duck egg export trade with China. In 1947, over 11 million duck eggs were shipped to China for the preparation of balut.

When the ducks become too old for profitable egg production, they are slaughtered and prepared as another specialized dish known as "dinogog". According to the recipe for dinogog, duck meat is cut in small pieces and tenderized by boiling with papaya. Various vegetables and herbs, principally ginger root, are added for the preparation of a sort of stew.

Infectious bronchitis, which has usually been considered a disease of young chicks, is increasing as an important cause of decreased egg production and poor egg quality. It is the general opinion of investigators that pullets contracting infectious bronchitis are likely to suffer a greater drop in egg production than pullets that suffer from Newcastle disease, avian pneumoencephalitis. The drop is not only greater but of longer duration. The effect on egg quality is similar to that seen in outbreaks in pneumoencephalitis. Control of the disease is being accomplished in some of the eastern states by the use of live virulent vaccines which are inoculated intratracheally. The usual procedure is to infect a small proportion of young chicks and these act as transmitters to the remainder of the brood. By this method, the typical disease is produced, but growers consider that the small resulting loss at the brooder stage more than offsets the financial loss in drop in egg production if infection occurs during the laying season.

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A good review of the poultry disease literature published in 1948 will be found in the annual report of the poultry disease committee of the U. S. Livestock Sanitary Association (*Proc.* 1948, p. 278). Included in the report is a summary of the progress being made in the pullorum disease control phase of the National Poultry Improvement Plan. According to this report, the number of hatcheries participating in the U.S. Pullorum Passed class has increased from 2% to 18% of the total, in the five-year period ending in 1948. The percentage increase for the U. S. Pullorum Clean class for the same period was from 9% to 16%. Since these classes represent the two top grades in the plan, the progress is encouraging, and shows that it is practicable to develop flocks which are free from the disease.

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Feed, water, and the mating process are important methods of transmission of fowl typhoid according to Goerdeuk (Penn. Agric. Exp. Bul., 502). The feeding of mash contaminated with manure from infected pullets for a period of ten days, resulted in losses of as high as 59.1%. Contaminated drinking water kept before the birds for six days caused losses of 31.8 and 69.6% in two trials.

Clinical Reports

Double Coxofemoral Luxation in a Cow

The economic loss due to endocrine disturbances is well illustrated in the following case report.

I was called to attend a Holstein cow because of the owner's concern over her loss of condition. The animal had some time previously suffered luxation of both femurs in an upward direction, probably due to the continuous mounting by other animals in the herd during the three-month period immediately preceding my visit. All of this time she had

showed nymphomaniac tendencies. The owner reported that the hips appeared to be out of joint for six weeks. When I saw her she could rise to her feet from a normal sternal position with remarkable agility and could walk slowly, interfering at the hocks. She had stopped milking completely. No treatment was recommended and an unfavorable prognosis was given. The animal was shipped for slaughter ten days later and was sold for $35.00, representing an unnecessary loss.

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Canine Actinomycosis

The subject, a male English Setter, four years' old, was successfully treated for heartworms five months previously.

The owner reported that the dog was slow in hunting and required more than usual rest and that the animal was losing weight. On examination, marked weakness and depression were noted. All visible mucous membrane was mildly iceteric. There was present a mucopurulent nasal discharge; stools were blood-tinged, having a fetid odor and the eyeballs seemed to have receded into their sockets. The temperature was normal. There was no pain nor abnormality on abdominal palpation. The heart was normal; lungs revealed areas of congestion.

Blood, urine and fecal studies were made. A hemogram showed the following: erythrocytes 4,570,000, leucocytes 37,500, hemoglobin 45%. Differential count: neutrophiles; segments 23.2%, stabs 0.5%, total 23.7%; lymphocytes; mature 59.6%, prolymphocytes 8.3%, total 67.9%; eosinophiles 8.2%, monocytes 8.2%.

Urine analysis: specific gravity 1.080; color, yellow amber; transparency, cloudy; reaction, acid; albumin, plus 4; acetone, plus 1; sugar, plus 2; bile, absent. Sediment: many hyaline casts, epithelial cells, and lymphocytes. Fecal examination revealed no parasites, but presence of blood.

A tentative diagnosis of leptospirosis was made. The animal was hospitalized on December 3 and died January 10. Penicillin, liver extract, solulexin, 5% dextrose in saline and whole blood transfusions were given throughout the course of illness, with depression and weakness becoming gradually more severe.

The gross postmortem examination revealed an enlarged liver with multiple surface and deep abscesses throughout the organ, on the peritoneum, as well as all lymph glands in the peritoneal cavity. The ileocecal lymph glands were conspicuously enlarged, causing a displacement of the cecum and large intestines. The enlarged heart showed cardiac hypertrophy and dilatation of the left ventricle with adhesions to the left lung. The lungs revealed patchy areas of atelectasis with pleurisy.

The viscera was sent to the Medical College of Virginia and the microscopic examination was performed by Dr. W. H. Talbot. The laboratory report was as follows:

Liver: Numerous sections of the liver show marked congestion and dilatation of the central veins and adjacent sinusoids with necrosis of

the liver cells in these areas. The portal fields show increased fibrous tissues with proliferation of the bile ducts and an infiltration by lymphocytes and plasma cells. There are extensive areas in which the liver substance had been replaced by abscesses of various sizes. The centers of these abscesses are composed of innumerable polymorphonuclear leucocytes with tissue debris and the peripheral portions are composed of innumerable macrophages, many of which have a foamy cytoplasm, together with lymphocytes and plasma cells. Surrounding these abscesses, there is extensive fibrosis in which chronic inflammatory cells are present and also macrophages filled with blood pigment. The centers of many of these abscesses contain irregular bluish masses with club-like projections around the periphery resembling actinomycosis. With special stains the mycelial filaments of the fungus are definitely identified, thus definitely establishing the organisms as actinomyces.

Abdominal Mass: Sections of the abdominal mass, including the intestinal tract, show the same microscopic appearance as the liver.

Gall Bladder: One section shows the subserosa is infiltrated by large numbers of chronic inflammatory cells, chiefly lymphocytes and plasma cells, but also a few macrophages.

Kidneys: Many of the convoluted tubules contain hyaline casts while still others contain an eosinophilic granular fluid. Most of the glomeruli are likewise filled with a similar fluid. There are scattered foci of infiltration by chronic inflammatory cells, chiefly lymphocytes and plasma cells, both in the cortex and the submucosa of the pelvis.

Spleen: The spleen shows a diffuse infiltration by numerous chronic inflammatory cells, chiefly lymphocytes and plasma cells. There are also scattered macrophages, most of which contain blood pigment.

Lungs: Two sections show marked congestion throughout with patchy atelectasis manifested by collapse of the alveoli and also scattered deposits of carbon pigment. The pleura in places is covered by a thick layer of granulation tissue which is infiltrated by numerous polymorphonuclear leucocytes, macrophages, lymphocytes and plasma cells.

Lymph Node: Numerous sections of lymph node show the lymph sinuses to be filled with red blood cells and polymorphonuclear leucocytes. There are innumerable macrophages scattered throughout, filled with blood pigment. The connective tissue surrounding the lymph node shows extensive fibrosis with an infiltration by plasma cells, lymphocytes and numerous macrophages.

Anatomical Diagnosis: Actinomycosis of liver and peritoneal cavity. Pulmonary congestion with patch atelectasis and focal organizing pleurisy. Chronic passive congestion of liver with central necrosis. Acute lymphadenitis of bronchial and ileocecal lymph nodes.

Comments

Though a tentative diagnosis of leptospirosis was made, this was not confirmed. The generalized symptoms were inconclusive and at no time during the course was actinomycosis suspected. Perhaps blood cultures might have provided a clue.

A review of the literature gives little information on the subject and the infection is reported to be rare.

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Q Fever Organism Demonstrated in the Brown Dog Tick

The infectious agent of Q fever, the rickettsia *Coxiella burnetii*, has been recovered from naturally infected brown dog ticks (Rhipicephalus saguineus) is reported by R. R. Parker and Oscar Sussman in *Public Health Reports* for September 9, 1949.

Sterile emulsion made from the bodies of 18 live ticks removed from a dog in Phoenix, Arizona, produced a febrile reaction in guinea pigs, later shown to be due to the Q fever rickettsia. Repeated passage through guinea pigs and recovery of the infectious agent are reported. Gross pathology in sacrificed animals and the emaciation exhibited by surviving animals were identified with the frequently observed lesions in Q fever-infected guinea pigs.

The demonstration of the spontaneous infection of brown dog tick with *C. burnetii* is reported here for the first time. No comments are made with reference to the role of the tick as vector or symptoms shown by the infested dog from which the ticks were collected.

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Stability of Bacitracin

Studies indicate that bacitracin is much the same as penicillin as regards stability. Dry bacitracin is quite stable up to 37°C. but from 56 to 80°C. there is definite decomposition. In aqueous solution the drug is said to be much less stable. However, if aqueous solutions are adjusted to pH 5-7 they are stable for several months at refrigerator temperature. Water miscible solutions have not been successful but, it is reported, bacitracin ointments using anhydrous grease bases are stable at room temperature.

Abstracts

Virus Papular Dermatitis of the Horse

A mild form of skin disease affecting Thoroughbreds that appears to be highly contagious and infective[43] is reported to exist in California.

The first case was observed on April 16, 1948, in a two-year-old filly. Several other cases are reported on which laboratory work has been done to establish the etiological agent as a virus.

Lesions consist of small papular swellings in the skin. These numerous concentric circumscribed areas, usually about the size of a "BB" shot, some larger, may appear over any region or the entire body surface. There is not associated pruritis or discomfort.

Efforts to demonstrate ectoparasites, microfilaria, or fungi were negative. Sterile filtrates from scraping caused the death of 11-day-old chick embryo in from four to seven days. Injection of 0.5cc of allantoic fluid from these inoculated eggs reproduced the disease in horses. Virus was recovered from experimentally infected horses by egg passage.

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The Importance to the Ruminant of Normal Microorganisms[44]

The rumen is slightly developed at birth, and increases in size under the stimulus of solid food. In the adult bovine, the filled rumen equals about one-fifth of the total weight. It is not just a storage chamber, but an efficient incubator in which rapidly multiplying microörganisms convert feedstuffs into nutriment.

All carbohydrates existing in nature must undergo change before they can be utilized by the tissues. These changes are largely brought about by enzymes, but no mammal is known to produce an enzyme that will change cellulose or lignin into soluble compounds. This process can only be accomplished through the medium of microörganisms in the digestive tract.

The usual food of the ruminant contains more acid-forming carbohydrates than alkali-forming protein; the excess acid is neutralized by the alkaline saliva, which is secreted at the rate of about 45cc per pound body weight per day. This saliva contains no enzymes.

The contractions of the rumen cause a constant mixing of its contents, while the lighter ingesta at the surface of the liquid are constantly sprayed with the liquid. Thus any parts made soluble, and finely divided particles, tend to sink to lower levels and pass on into the true stomach. The lighter the material, the longer it will remain in the rumen, and the more thoroughly it will be exposed to bacterial action.

Grains will not remain in the rumen as long as roughage. It is known that one-fourth to one-half of dry whole corn ingested is voided unused in the feces, meaning that it by-passed the rumen or was never regurgitated. Ground corn remains a shorter time in the rumen than whole or cracked grain; however, cracked grain is more efficiently utilized than whole grain. The significance of the size of the particle is not well known. It has been shown that silage alone is masticated more completely than silage plus corn meal, and in ratio to the amount of corn meal added. Sugar passes through more rapidly than starch and thus starch is better than molasses when urea is being fed. The starch is a source of energy for the bacteria that are building up protein from the urea, but they have no time to make full use of sugar.

The bolus passed up the esophagus for chewing is not formed from the food most recently digested, but from that which has been in the rumen for 12 to 24 hours. It has been changed by bacterial action so that mastication is more effective than it would have been earlier.

Grinding processes other than chewing are at work. The motion of the rumen tends to tear fibers apart. The friction of swimming protozoa is more effective than would be supposed, and these creatures also bite pieces off or ingest large particles. Starch is digested and glycogen accumulated by protozoa, but their cellulose-splitting ability is questionable. The powerful action of the abomasum is obvious from its appearance.

The Microorganisms

It has been estimated that about ten per cent of the total volume of rumen contents consists of microörganisms, and it has thus been suggested that the ruminant lives not on the material ingested but upon the mass of these microörganisms breeding on the ingesta.

The majority of the bacteria found in the rumen have not been found elsewhere and cannot be cultivated in the laboratory. They are apparently distinctive and young animals derive them from associated adults. They are supplemented by additional heterogeneous organisms entering the rumen with the feed, which may or may not be of value.

The protozoa are the most noticeable under the microscope because of their size and motil-

[43]McIntyre, R. W., Virus Papular dermatitis of the horse. *Amer. Jour. Vet. Res.* 10:229 (July), 1949.
[44]Abstracted from the monograph of E. G. Hastings, *Bacteriological Reviews*, 8:235.

ity. Their chemical task is unknown, and it is possible that they are not absolutely necessary to the well-being of the ruminant. They reproduce at the rate of about four generations a day, being constantly removed into the true stomach where they are digested and serve as food.

Possibly nowhere else are bacteria so dense as in the rumen, but cultural methods do not reveal the myriads visible under the microscope, since only about one cell out of each hundred or thousand is a type that can be cultured. The same is true of bacteria in the feces.

There are a great many types and varieties of bacteria in the digestive tract, and the popular idea that the biology of the tract can be altered through varying the diet is probably not well founded. In the ruminant, at least, it does not seem probable that ordinary dietary changes would vary the flora, and any class of nutriment will have much the same value if it yields much the same kind of crop of microörganisms.

It is believed that the total transformation of nitrogen of all sources in the rumen to the protein of microörganisms may well approximate the total protein requirements of the animal. One must consider that the microörganisms are building from the ingesta a mass of new organic material, which is then made available to the host.

Nonruminant herbivora have a cecum that seems to serve much the same purpose as the rumen. For example, food eaten by the horse, if it has not been digested in the upper part of the tract, enters the cecum where it is exposed to prolonged action of bacteria and protozoa. The ability of the horse to digest cellulose is dependent on this mechanism. The large cecum of the rabbit plays a similar role.

The vitamin requirements of a higher animal cannot be learned unless the animals can be kept free from microörganisms for a considerable time, since many of these synthesize vitamin elements in the body. One can determine only the kind and amount of vitamins that must be supplied in the feed. Some students of nutrition believe that all the higher animals require the same vitamins, perhaps in the same proportions, apparent differences in requirements being due to real differences in the function of the typical flora.

The bacterial content of the small and large bowel increases as the lower levels are reached. These bacteria are probably not living entirely on the undigested residue of food, since the food has already been exposed to a series of active agents that would seem able to accomplish all that any of the bacteria here could accomplish. It seems rather more probable that the food for such bacteria is the organic matter excreted into the lower part of the tract, which forms a large part of the fecal matter.

The eating of feces is claimed to be a constant phenomenon in the rabbit and the rat, and is practiced by many others animals either throughout life or for certain periods. This is commonly assumed to be caused by dietary deficiency, but it may be a perfectly natural phenomenon, a regenerative mechanism whereby by-products are returned to the system for use.—A. H. QUIN.

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Canine Hysteria

In a clinical report, the author states that he has always noted that cases of hysteria in dogs[41] were invariably found in animals fed a diet deficient in meat offal. Pet owners usually think of meat as only lean muscle tissue cooked until many of the heat labile nourishing properties have vanished. War and postwar rationing in England have made it almost impossible to provide a carnivorous diet for dogs with an increase in feeding biscuit, also of rather poor quality, and resulting hysteria.

Hysteria cases are fed only liver (boiled, condemned livers), and cleaned and ground ox rumen and recticulum. Treatment consists of supplying about a tablespoon of raw, minced liver soaked in cod-liver oil, fed twice daily. Regular recoveries are reported after a week's treatment. No sedatives or other drugs are given. Liver extract or desiccated pig stomach extract have substituted for the raw liver feeding. According to the author, depriving the animal of any agenized meal is not the key to the success of this treatment.

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Blood samples drawn during the epizootic of equine encephalomyelitis in Japan in 1948, disclosed neutralizing antibodies against this disease in cattle. The weekly bulletin of Headquarters of the Supreme Commander for the Allied Powers dealing with public health, states that additional studies are being made as this may be a new disease entity of cattle.

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The state of Delaware led the nation last year in broiler production, marketing 53 million chickens of frying size, which sold for approximately 57 million dollars.—*Poultry Digest.*

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[41]Anthony, David J., Treatment of Canine Hysteria by Raw Liver. *Brit. Vet. Jour.* 105:66-67 (Feb.), 1949.